



Macintosh Computers
Volume III

Service Guide

July 1994

To Apple On-Site Technicians:

Help us make sure the *Apple Service Guides for Macintosh Computers* meet your on-site technical information needs. Send your comments and recommendations to the AppleLink® address below. We will consider all recommendations for future releases of the guide and, whenever possible, reply to your recommendations.

AppleLink: STP.DOC

No portion of this document may be produced in any form without the written permission of Apple Computer, Inc.

©1994 Apple Computer, Inc.

Apple, the Apple logo, AppleCD SC, AppleLink, AppleShare, Apple SuperDrive, AppleTalk, A/UX, FDHD, HyperCard, ImageWriter, LaserWriter, Mac, Macintosh, Macintosh Centris, Macintosh Quadra, Performa, and PowerBook are trademarks of Apple Computer, Inc., registered in the U.S. and other countries.

Classic is a registered trademark licensed to Apple Computer, Inc., registered in the U.S. and other countries.

AppleCD, Apple Desktop Bus, AppleFax, AppleLine, AppleMail, AppleScript, At Ease, AudioVision, DigiSign, Disk First Aid, Finder, GeoPort, Macintosh Duo, MacTest, PowerBook Duo, Power Macintosh, PowerShare, PowerTalk, QuickDraw, QuickTime, and TrueType are trademarks of Apple Computer, Inc.

NuBus is a trademark of Texas Instruments. PowerPC and the PowerPC logo are trademarks of International Business Machines Corporation, used under license therefrom.

No portions of this document may be reproduced in any form without the written permission of Apple Computer, Inc.

Table of Contents

Introduction.....	1
Chapter 1 CRT and ESD Safety	
CRT Safety	4
Safety Warnings.....	5
Discharging and Disposing of the CRT	6
Discharge Procedure.....	6
Disposing of the Cathode-Ray Tube (CRT)	6
Devacuuming Procedure	8
ESD Safety	9
ESD Prevention Rules	9
Setting Up an ESD-Safe Workstation	10
Chapter 2 General Information	
SIMM Compatibility Chart.....	12
SIMM Information	14
Composite SIMMs	14
Double-Sided SIMMs.....	15
RAM Upgrade Table.....	16
VRAM Chart.....	19
Macintosh to Performa Comparison Chart	21
Installation Procedures.....	22
DRAM and VRAM SIMM Installation.....	22
Expansion Card Installation.....	22
Quadra 610/WS 60 CPU Replacement	22
Color Classic Math Coprocessor Installation.....	22
Power Macintosh System Overview	24
Battery and AC Adapter Verification.....	26
Lithium Battery Verification.....	26
NiCad Battery Verification	26
Nickel-Metal-Hydride Battery Verification	27
AC Adapter Verification.....	27
Duo AC Adapter Verification	27
CTIA Module Symptom Codes	29
Chapter 3 General Troubleshooting	
Initial Troubleshooting	34
Overall Approach.....	34
Telephone and On-Site Quick Checks	34
Information Gathering.....	34
Software Troubleshooting	35
System-Crash Checklist.....	35

Desktop Procedures and Practices	36
System Enablers.....	39
Some General Rules About Enablers	39
System Enablers Versions	40
Preparing to Install System 7.1 Software.....	42
Back Up Your Hard Drive	42
Disable Virus and Security Software	42
Prepare for a Clean Installation	43
Remove Unnecessary and Incompatible Files.....	43
Check Available Hard Drive Space	43
Check Compatibility.....	44
Run Disk First Aid.....	44
Update Hard Disk Drivers	44
Installing System 7.1 Software	46
Easy Install	46
Customize Install.....	47
Net Install.....	47
After Installation is Complete.....	47
System 7 Pro.....	48
PowerTalk	48
AppleScript	49
QuickTime	50
Apple Software Restoration CD	51
Apple Software Restoration CD System Software	51
Apple Software Restoration CD Market Software Series Volumes 1 and 2	51
Hardware Troubleshooting.....	52
Isolating a Hardware Problem	52
Hardware Troubleshooting Guidelines.....	53
Startup Problems – Flowcharts	54
MacTest Pro.....	60
Additional Sources of Information.....	60
How to Obtain MacTest Pro	60
Suggestions for Using MacTest Pro.....	60
MacTest Pro Bootable Disk Configurations.....	61
Macintosh CPU Tests, Volume 1A	61
Macintosh CPU Tests, Volume 1B	62
Macintosh CPU Tests, Volume 2	62
Macintosh CPU Tests, Volume 3	62
PowerBook Tests, Volume 1.....	63
PowerBook Duo Tests, Volume 1	63
Power Macintosh CPU Tests, Volume 1	63
Power Macintosh Upgrade Card Tests.....	63
Apple Personal Diagnostics.....	64

Chapter 4 Ports and Pin-Outs

Cable Connectors	66
Pinouts.....	67
GeoPort – Mini DIN-9.....	67
Apple Desktop Bus Connector.....	67
Modem and Printer Ports.....	68
RCA Jack Pinout.....	68
HDI-45.....	69
Ethernet – AAUI Connector Pinouts.....	70
Audio Output Connector – Stereo	71
Audio Output Connector – Monoaural	71
Microphone Input Connector.....	71
HDI-30 and BR-50 SCSI Disk Adapter Cable	72
External Video Connector	73
SCSI Connector – DB-25	74
SCSI Connector – HDI-30	75
External Floppy Drive Connector – HDI-20.....	76
External Monitor Connector.....	77
S-Video Input	77
Coax/Twinax Interface Card – Coax Connector	78
Coax/Twinax Interface Card – Twinax Connector.....	78
Computer Port Locations.....	79

Chapter 5 Power Macintosh Upgrade Card

Specifications	86
Macintosh PDS Slot Locations	87
Symptom/Cure Chart	88

Chapter 6 Macintosh Color Classic

Illustrated Parts List	90
Logic Board Diagram.....	92
Specifications	93
Symptom/Cure Chart	94
Upgrades	99
VRAM Upgrade	99
DRAM Upgrade.....	99
Math Coprocessor Upgrade.....	99
PDS Upgrades.....	99
Video Adjustments.....	100
Geometry Adjustments.....	100
Centering Adjustments	100

Size Adjustments	100
Focus.....	100
Cutoff	102
White Balance.....	102
Convergence.....	103
Geometric Distortion Adjustments.....	103
Yoke Adjustments	104
 Chapter 7 Macintosh LC 520, 550, 575; Performa 550, 560, 575, 578; Macintosh TV	
Illustrated Parts List	106
Bezel, Chassis, and Drive Configurations	110
Specifications	112
Symptom/Cure Chart	114
Video Adjustments.....	120
Geometry Adjustments	120
Centering Adjustments	120
Size Adjustments	120
Focus.....	120
Cutoff	122
White Balance.....	122
Convergence.....	123
Geometric Distortion Adjustments.....	123
Yoke Adjustments	124
Additional Information.....	125
Identifying Features	125
Compatibility Notes	125
Communications Slot.....	125
Logic Board Diagrams	126
 Chapter 8 Macintosh LC III, 475; Performa 405, 410, 430, 450, 460, 466, 467, 475, 476; Macintosh Quadra 605	
Illustrated Parts List	128
Specifications	132
Product Comparison	134
Symptom/Cure Chart	135
Additional Procedures	140
Grounding Connector Replacement	140
Quadra 605 Logic Board Jumper Replacement.....	140
Macintosh LC Upgrades	141
LC to LC III Upgrade	141
LC II to LC III Upgrade	141

LC 475 Upgrade	142
LC Ethernet Upgrade	142
Logic Board Diagrams	143

Chapter 9 Macintosh Quadra 610, 660AV; Power Macintosh 6100; WS 60, WS 6150

Illustrated Parts List	146
Specifications – Quadra 610, 660AV; WS 60	150
Specifications – Power Macintosh 6100; WS 6150	152
Symptom/Cure Chart – Quadra 660AV.....	154
Troubleshooting Tips – Power Macintosh 6100; WS 6150	159
Symptom/Cure Chart – Quadra 610; Power Macintosh 6100; WS 60, WS 6150	160
Additional Procedures	164
Expansion Card Installation.....	164
CPU Replacement – Quadra 610; WS 60	164
Reset Logic Board – Power Macintosh 6100	166
Upgrades	167
CD-ROM Drive Upgrade	167
Quadra 610 to 660AV Upgrade	168
Quadra 610/660AV to Power Macintosh 6100/60 or 6100/60AV Upgrade	169
Macintosh Cards	171
Power Macintosh AV Card	171
DOS Compatibility Card	171
Logic Board Diagrams	172

Chapter 10 Macintosh Quadra 650; Power Macintosh 7100

Illustrated Parts List	174
Specifications – Quadra 650	178
Specifications – Power Macintosh 7100.....	179
Symptom/Cure Chart – Quadra 650	181
Troubleshooting Tips – Power Macintosh 7100	185
Symptom/Cure Chart – Power Macintosh 7100.....	186
Reset Logic Board – Power Macintosh 7100.....	191
Upgrades	192
CD-ROM Drive Upgrade	192
Quadra 650 to Power Macintosh 7100/66 or 7100/66AV Upgrade	193
Power Macintosh Cards.....	195
Power Macintosh 2 MB Video Card.....	195
Power Macintosh AV Card	195
Logic Board Diagrams	196

Chapter 11 Macintosh Quadra 800, 840AV; Power Macintosh 8100; WS 80, WS 8150

Illustrated Parts List	198
Specifications – Quadra 800, 840AV; WS 80	202
Specifications – Power Macintosh 8100; WS 8150	204
Symptom/Cure Chart – Quadra 800, 840AV; WS 80	206
Troubleshooting Tips – Power Macintosh 8100; WS 8150	212
Symptom/Cure Chart – Power Macintosh 8100; WS 8150	213
Reset Logic Board – Power Macintosh 8100; WS 8150	218
Upgrades	219
CD-ROM Drive Upgrade	219
Quadra 800/840AV to Power Macintosh 8100/80 or 8100/80AV Upgrade	220
Power Macintosh Cards	221
Power Macintosh 4 MB Video Card.....	221
Power Macintosh AV Card	221
Logic Board Diagrams	222

Chapter 12 Workgroup Server 95; Workgroup Server 9150

Illustrated Parts List	224
Specifications – Workgroup Server 95.....	228
Specifications – Workgroup Server 9150.....	229
Symptom/Cure Chart – Workgroup Server 95.....	230
Symptom/Cure Chart – Workgroup Server 9150.....	235
Reset Logic Board – Workgroup Server 9150.....	241
Upgrades	242
CD-ROM Drive Upgrade	242
Quadra 900/950 to WS 95 Upgrade.....	242
WS 95 Memory Cache Upgrade.....	243
WS 95 Tape Drive Upgrade.....	244
WS Five Drive Upgrade	245
WS 95 and WS 9150 Hard Drive Upgrade	246
Logic Board Diagrams	250

Chapter 13 PowerBook 145B, 165, 165c, 180c

Illustrated Parts List	252
Specifications	257
PowerBook Basics	259
Symptom/Cure Chart	260
Troubleshooting Flowchart	269
Additional Procedures.....	271

Modem Card Installation	271
RAM Expansion Cards	272
Shim Installation–PowerBook165.....	273
SCSI Termination	274
Battery Handling	274
Rev. C Display Bulb for PowerBook 145B/165.....	275
Mother and Daughterboard Diagrams.....	276

Chapter 14 PowerBook 520, 520c, 540, 540c

Illustrated Parts List	278
Specifications	281
Troubleshooting Flowchart	283
Symptom/Cure Chart	285
Additional Procedures	293
Modem and DAA Card Installation	293
Modem Country Adapter	293
To Use the Adapter	294
RAM Expansion Card.....	294
PowerBook 540c Upgrade	294
Logic Board Diagrams	295

Chapter 15 Macintosh PowerBook Duo 250, 270c, 280, 280c

Illustrated Parts List	298
Specifications	302
Symptom/Cure Chart	304
Additional Procedures	314
Modem	314
Memory Expansion	314
Resetting the Power Manager.....	315
Floppy Adapter Installation	315
Battery Contact Alignment Tool.....	316
Replacing the CPU Stiffener	318
Battery Handling	319
Battery Recharger.....	320
PowerBook Duo Upgrades	321
Logic Board Diagrams	322

Chapter 16 Macintosh DuoDock II

Illustrated Parts List	324
Specifications	326
Symptom/Cure Chart	328
DuoDock II Upgrade.....	334
Logic Board Diagram.....	334

Introduction

Welcome to *Apple Service Guide for Macintosh Computers, Volume III*. This volume does not replace Volumes I and II.

- Volume I covers all compact and portable Macintosh computers introduced prior to January 1993. These computers do not require an external monitor.
- Volume II covers all modular Macintosh computers introduced prior to January 1993.
- Volume III covers all compact, portable, and modular Macintosh computers introduced between January 1993 and May 1994:
 - Macintosh Color Classic
 - Macintosh LC III, LC 475, 520, 550, and 575
 - Performa 405, 410, 430, 450, 460, 466, 467, 475, 476, 550, 560, 575, 577, and 578
 - Macintosh Quadra 605, 610, 650, 660AV, 800, and 840AV
 - Power Macintosh 6100, 7100, and 8100
 - Workgroup Server 60, 80, 95, 6150, 8150, and 9150
 - PowerBook 145B, 165, 165c, 180c, 520, 520c, 540, and 540c
 - PowerBook Duo 250, 270c, 280, and 280c
 - PowerBook Duo Dock II
 - Macintosh TV

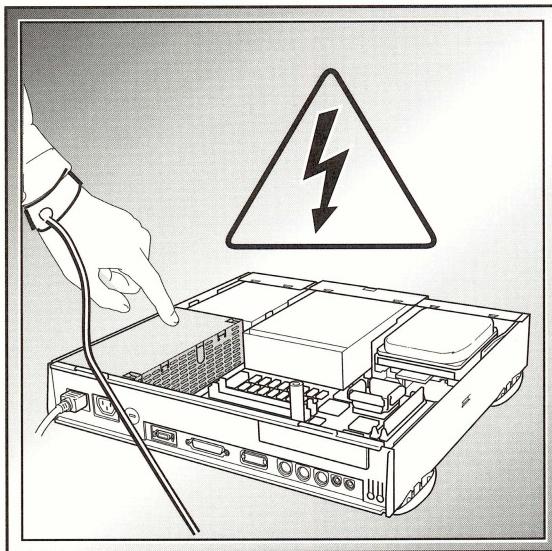
Note

The Centris name was discontinued from the Macintosh product line in November 1993. The Centris 610 was replaced by the Macintosh Quadra 610, the Centris 650 by the Quadra 650, and the Centris 660AV by the Quadra 660AV. Reference the respective Quadra chapters for information on Centris computers.

Important

When ordering a replacement module or spare part, be sure to check the part number given in this guide against the current Price Pages.

CRT and ESD Safety



CRT Safety	4
Safety Warnings	5
Discharging and Disposing of the	
CRT	6
ESD Safety	9

CRT Safety

Please follow these 10 rules of CRT safety:

1. Do not work on a monitor alone. In case of an accident, having someone nearby—and having someone trained in CPR—could save your life.
2. Remove all jewelry before performing repairs on a CRT. Removing these conductors reduces the possibility of electric shock.
3. Never use a grounding wriststrap or heelstrap or work on a grounded workbench mat when discharging a monitor or when performing live adjustments. Grounding straps and mats are used to protect sensitive components from ESD damage and should be used only when working on “dead” (uncharged) equipment.
4. Wear safety goggles when working with a CRT. The CRT contains a high vacuum. If cracked or broken, the CRT can implode (collapse into itself). To protect your eyes, always wear safety goggles.
5. Before working inside a monitor, turn off the power and disconnect the AC power cord. Certain parts of a monitor chassis are live (electrified) when the monitor is under power. Never work on a monitor under power except when making live adjustments.
6. When working on a live monitor, keep one hand in your pocket or behind your back. This reduces the risk of current passing through your body, should you accidentally contact high voltage.
7. Always discharge the anode before touching anything inside the monitor. High voltage (up to 12,000 volts DC) can be present on the anode and other components—even when power is off.
8. Never touch the anode connector or the anode aperture. When a CRT is replaced, the anode connector is removed, exposing the anode. The anode can retain a charge of several thousand volts even when power is off and can regain some charge even after being discharged.
9. Do not pick up or handle a CRT by its neck (see Figure 1-A). To prevent an implosion, take every precaution against breaking the tube. Be especially careful with the neck, where the tube is thinnest.
10. In addition, never touch the following components (see Figure 1-A) when adjusting a live Macintosh CRT:
 - Back of the power switch
 - Yoke wires
 - Anode connector
 - Anode wire
 - Flyback transformer

Safety Warnings

- ▲ **Warning** The compact Macintosh computers contain high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, make sure you read and understand the safety precautions in this section.
- ▲ **Warning** Voltage and video adjustments are performed with the power on. Review the cathode-ray tube (CRT) safety and live adjustment rules before performing these adjustments.
- ▲ **Warning** Failure to follow the rules for safe CRT discharge could result in serious injury or property damage. For compact Macintosh computers, the CRT must be discharged to the ground lug to prevent damage to the logic board.
- ▲ **Warning** Make sure that you are not grounded when:
- You work on plugged-in equipment
 - You discharge a cathode-ray tube (CRT)
 - You work on an unplugged CRT that has not been discharged
 - You perform live adjustments
- ▲ **Warning** Electrostatic discharge (ESD) can cause severe damage to sensitive microcircuits. Macintosh circuit boards contain CMOS components, among the most sensitive chips in use today. CMOS chips, ROMs, and SIMMs are very susceptible to ESD and skin acid damage. To prevent damage to these components, handle them only by the edges.
- ▲ **Warning** A "dead" lithium battery is considered hazardous waste and has some potential for explosion if improperly handled. Mark the battery *DEAD*, place it in a zip-locked wrapper and the packaging used to ship the replacement battery. Return the dead battery to Apple, where it will be disposed of following EPA guidelines. Exception: If the battery is physically damaged, do not return it to Apple; dispose of the battery locally according to local ordinances.

Discharging and Disposing of the CRT

Use the following procedure to discharge high voltage (12,000 volts) from the picture tube of a compact Macintosh. Use this procedure to discharge any Macintosh monitor.

-
- ▲ Warning** **Discharge the anode to the metal ground lug (see Figure 1-B). Failure to do so may damage the logic board.**
-

Discharge Procedure

1. Remove your grounding wriststrap and jewelry, and put on safety goggles.
2. Attach the alligator clip on the CRT discharge tool to the metal part of the ground lug (see Figure 1-B).
3. Put one hand in your pocket or behind your back. With your other hand, insert the tip of the CRT discharge tool under the anode cap until it touches the anode ring.
4. Remove the CRT discharge tool. To be sure the CRT is discharged, repeat the discharge procedure (you may want to repeat the procedure using a flat-blade screwdriver with an insulated handle).

Note

The anode can build up voltage over time. To drain off any residual charges, establish an ongoing ground. Fasten one end of an alligator lead to the ground lug and the other end to the anode aperture.

Disposing of the Cathode-Ray Tube (CRT)

To prevent serious injury, follow the procedure described in this section whenever discarding a CRT.

-
- ▲ Warning** **To properly dispose of a defective CRT, you must first devacuum the cathode-ray tube. Discarded CRTs that have not been devacuumed may crack and implode, injuring anyone nearby.**
-

Materials Required

Thick cardboard box large enough to contain the CRT
Large, sharp diagonal cutters
Large pliers and duct tape
Safety goggles and gardening gloves
12" x 12" piece of cloth or heavy paper

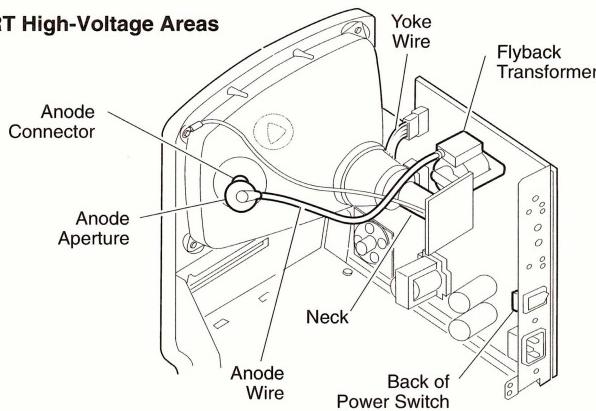
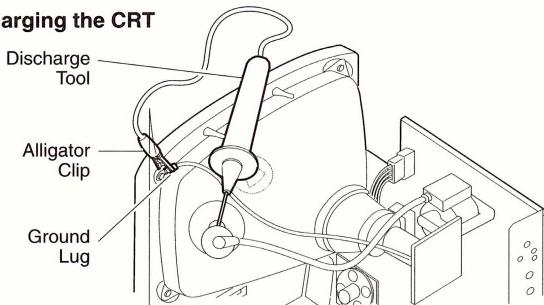
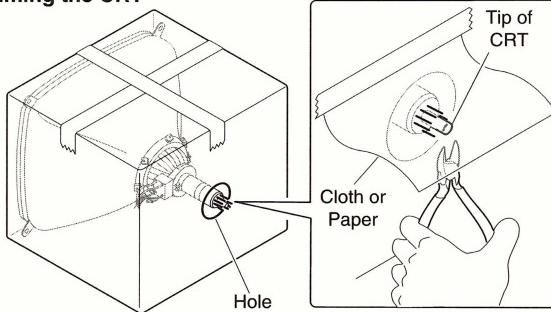
A CRT High-Voltage Areas**B Discharging the CRT****C Devacuuming the CRT**

Figure 1 Discharging and Disposing of the CRT

Devacuuming Procedure

1. Put on safety goggles.
2. In the side of the box, about six inches from the bottom, cut a hole just large enough to insert the tip of the CRT neck.
3. Place the CRT inside the box with the tip of the neck protruding through the hole, and tape the box flaps down with the duct tape (Figure 1-C).

▲ Warning

Only the very tip of the CRT neck should be protruding through the hole in the box, and the box must not have any other opening.

4. Put on the gloves and, using the diagonal cutters, carefully clip off the connector pins on the end of the CRT neck.
5. Tape the piece of cloth or paper onto the box so that it forms a veil over the opening, but allows access to the tip of the CRT (Figure 1-C). The purpose of the veil is to catch bits of glass that may fly during the next step.
6. Make sure no one is standing nearby. Then stand to one side, reach under the veil, and with the large pliers grasp the exposed tip of the CRT. Look away while you snip off the tip of the CRT.

Note

You will probably hear a rush of air entering the CRT when the CRT vacuum breaks—but even if you don't, the procedure is complete if the tip of the CRT is clearly broken off.

ESD Safety

Electrostatic discharge (ESD) can irreparably damage the sensitive CMOS chips and printed circuitry of modern electronic components. Plastic utensils, polystyrene products, polyester clothing, even the ungrounded touch of your hand carry sufficient electrostatic charges to damage electronic components. Follow the ESD prevention rules and set up an ESD-safe workstation as directed below.

ESD Prevention Rules

1. Before working on a device containing a printed circuit, ground yourself and your equipment. Use a grounded conductive workbench mat and a grounding wriststrap, and ground your equipment to the mat.

▲ Warning**Make sure that you are not grounded when:**

- You work on plugged-in equipment
- You discharge a cathode-ray tube (CRT)
- You work on an unplugged CRT that has not been discharged
- You perform live adjustments

2. Do not touch anybody who is working on integrated circuits. You could “zap” the equipment through the technician—even if the technician is grounded.
3. Use static-shielding bags for boards and chips during storage, transportation, and handling. Leave all Apple service exchange components in their ESD-safe packaging until you need them.
4. Handle all ICs by the body, not the leads. Also, do not touch the edge connectors or exposed circuitry on boards or cards.
5. Do not wear polyester clothing or bring plastic, vinyl, or polystyrene into the work environment. The electrostatic field around these nonconductors cannot be removed.
6. Never place components on any metal surface. Use antistatic, conductive, or foam rubber mats.
7. If possible, keep the humidity in the service area between 70% and 90%, and use an ion generator. Charge levels are reduced (but not eliminated) in high-humidity environments and in areas with ion generators.
8. If an ESD pad/workstation is not available, touch bare metal on the power supply to discharge electrostatic charges.

Setting Up an ESD-Safe Workstation

Materials Required

Conductive workbench mat with ground cord

Wriststrap with built-in 1-megohm resistor and ground cord

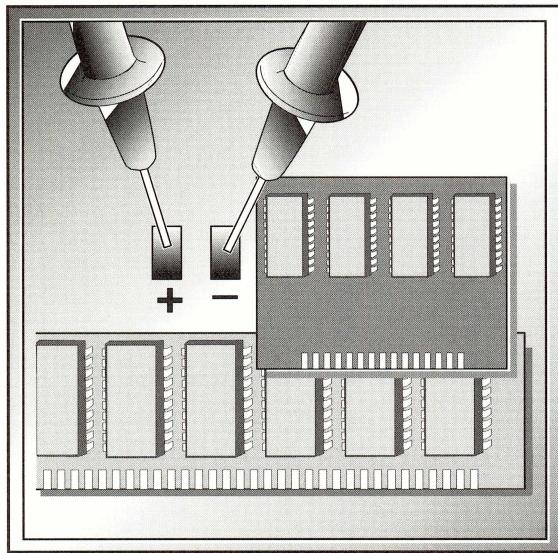
Equipment ground cord with alligator clips

Ground/polarity tester

1. Remove all ESD hazards from the area. Nonconductive materials (for example, polyester, plastic, vinyl, and polystyrene) cannot be grounded and retain charges for hours and even days.
2. Use a ground/polarity tester to verify proper grounding of the power outlet. If the outlet is wired incorrectly, most testers show a light pattern that matches a code given on the tester. If the tester does not verify proper grounding, move to another outlet that is safe.
3. Connect the grounding cord of the workbench mat to ground.
4. Use a wriststrap grounding cord. Fasten it to the workbench mat and to the wriststrap. The wriststrap must touch your skin.
5. Finally, ground the equipment you are working on. Use alligator clips and a grounding cord to attach any metal part of the equipment to the grounded workbench mat.

General Information

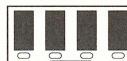
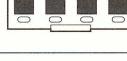
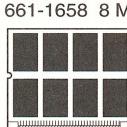
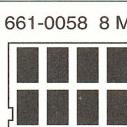
2



SIMM Compatibility Chart	12
SIMM Information	14
RAM Upgrade Table	16
VRAM Chart	19
Macintosh to Performa Comparison	21
Installation Procedures	22
Power Macintosh System Overview	24
Battery and AC Adapter Verification	26
CTIA Module Symptom Codes	29

SIMM Compatibility Charts

DRAM SIMMs for Service Exchange Modules		Macintosh Computers																	
		Color Classic	LC500 Series	Performa 500 Series	Mac TV	LC III/475	Performa 400	Quadra 605	Quadra 610/WS 60	Quadra 650	Quadra 660AV	Quadra 800/840AV	Power Mac 6100	Power Mac 7100	Power Mac 8100	WS 6150	WS 8150	WS 9150	WS 95
661-0520	SOJ 1 MB 80 ns 30-pin				■												■		
661-0719	SOJ 1 MB 80 ns 30-pin				■												■		
661-0643	SOJ 2 MB 80 ns 30-pin				■														
661-0734	SOJ 1 MB 80 ns 72-pin				■	■	■	■	■	■	■	■							
661-0808	4 MB 80 ns 72-pin				■	■	■	■	■	■	■	■				■	■	■	■
661-0809	8 MB 80 ns 72-pin				■	■	■	■	■	■	■	■				■	■	■	■
661-1701	4 MB 60 ns 72-pin												■	■	■				
661-1702	8 MB 60 ns 72-pin												■	■	■				
661-0811	DRAM 4 x 9 MB 80 ns, Parity, 30-pin																	■	
661-1024	Level 2 cache SIMM															■	■	■	■

PowerBook RAM for Service Exchange Modules		Macintosh Computers							
661-0715 2 MB, 100 ns									
661-0790 4 MB, 85 ns									
661-0714 4 MB, 100 ns									
661-1659 4 MB, 70 ns									
661-1658 8 MB, 70 ns									
661-0058 8 MB, 70 ns									

Apple recommends against using composite SIMMs in any Macintosh computer. Apple hasn't tested composite SIMMs, and there are known problems with some CPUs. This information will tell you what some of the problems are and how to identify composite SIMMs.

Composite SIMMs

A composite SIMM uses lower-density components to construct a single bank of memory. It forms a large memory SIMM using many smaller DRAM chips along with additional bank-controlling circuitry and sometimes buffers for the address and control signals, deceiving the Macintosh memory controller circuitry.

Composite SIMMs are less expensive than noncomposite SIMMs because they are made with less expensive components. An example of a composite SIMM is a 16 MB SIMM that uses 32 4 MB DRAM chips. A noncomposite 16 MB SIMM uses eight 16 MB chips to construct one bank of memory.

Composite SIMMs pose timing and electrical problems in some Macintosh computers, particularly those optimized for maximum DRAM performance, such as the Quadra 800 and 900 series. Composite SIMMs with signal buffering have caused floppy disk (especially 800K) mounting problems on the Macintosh AV computers. The additional circuitry in the composite SIMMs causes random memory failures due to:

- Higher electrical currents
- Increased system noise
- The added timing overhead (delay)

Composite SIMMs may work under some conditions, but may cause random problems such as startup failures, system errors, or unexplained crashes. The errors can vary with different SIMMs, SIMM configurations, and vendors. Two composite SIMMs may work, but four may begin to cause random failures. One CPU might behave differently than the same model manufactured at a different time. Even temperature and supply voltages can cause minute variations.

Some SIMM vendors claim to have solved the loading and timing issues. However, the Macintosh memory system is tuned to expect the loading of standard SIMMs. Apple systems are verified to work with eight memory chips per bank (plus parity chips when applicable).

Double-Sided SIMMs

The double-sided SIMMs available for use in the newer Macintosh systems are not composite SIMMs. A double-sided SIMM consists of two separate banks of memory using the correct density components for each bank. An example would be a double-sided 8 MB SIMM, which uses 4 MB components to construct two separate banks of 4 MB each. These SIMMs can be used in Macintosh Quadra and Centris systems because the design of the logic board allows each SIMM slot to contain two banks of memory, not just one as in previous systems.

If a bank of memory is to contain 4 MB, the components for that bank should be 4 MB. If the bank is to contain 16 MB, the components that make up that bank must be 16 MB.

See Figure 1 for a generic representation of composite and noncomposite SIMMs. SIMMs come in many shapes and sizes—use this graphic only as a general guide.

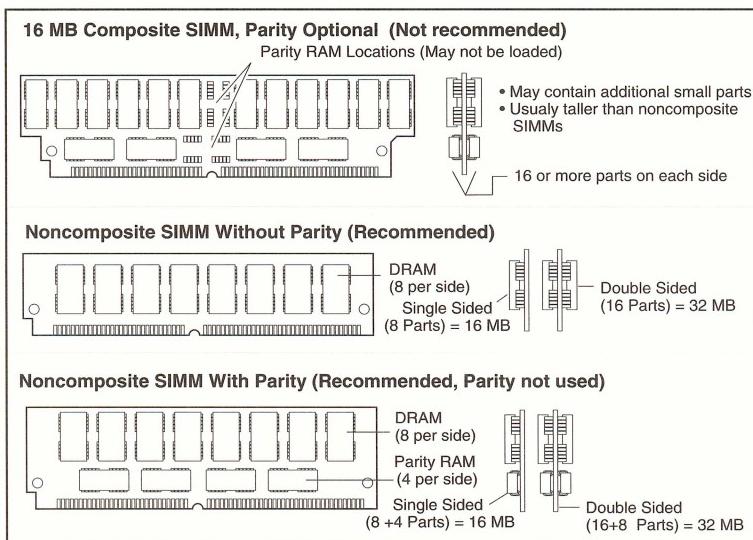


Figure 1 Composite and Noncomposite SIMMs

RAM Upgrade Table

Use the RAM upgrade table to identify standard RAM configurations, possible RAM upgrades, SIMM sizes, and SIMM speed.

Macintosh Computer	RAM Soldered on Logic Board	Possible RAM Configurations	Possible SIMM Sizes	SIMM Speed	Number of Pins on SIMM
Color Classic	4 MB	4, 6, 8, 10 MB	1, 2, 4 MB	100 ns	30 pin
LC 550	4 MB	4, 5, 6, 8, 16, 32 MB	1, 2, 4, 8, 16, 32 MB	80 ns	72 pin
LC II; Performa 405, 410, 430	2, 4 MB	2, 6, 8, 10 MB	1, 2, 4 MB	100 ns	30 pin
LC III; Performa 450, 460, 466, 467	4 MB	4, 6, 8, 12, 20, 36 MB	1, 2, 4, 8, 16, 32 MB	80 ns	72 pin
LC 475; Performa 475, 476; Quadra 605	4 MB	4, 5, 6, 8, 12, 20, 32 MB	1, 2, 4, 8, 16, 32 MB	80 ns	72 pin
LC 520, 550, 575; Performa 550, 560	4 MB	4, 5, 6, 8, 12, 20, 36 MB	1, 2, 4, 8, 16, 32 MB	80 ns	72 pin
Performa 575, 577	5 MB	numerous combinations up to 36 MB	1, 2, 4, 8, 16, 32 MB	80 ns	72 pin
Performa 578	8 MB	numerous combinations up to 36 MB	1, 2, 4, 8, 16, 32 MB	80 ns	72 pin

Macintosh Computer	RAM Soldered on Logic Board	Possible RAM Configurations	Possible SIMM Sizes	SIMM Speed	Number of Pins on SIMM
Quadra 610; WS 60	4 MB	numerous combinations up to 68 MB	4, 8, 16, 32 MB	80 ns	72pin
Quadra 650	4, 8 MB	numerous combinations up to 136 MB	4, 8, 16, 32 MB	80 ns	72pin
Quadra 800, 840AV; WS 80	8 MB	numerous combinations up to 136 MB	4, 8, 16, 32 MB	60 ns	72pin
Quadra 900, 950; WS 95	0	numerous combinations up to 256 MB	1, 4, 8, 16 MB	80 ns	30 pin
Quadra 660AV	4 MB	numerous combinations up to 68 MB	4, 8, 16, 32 MB	70 ns	72 pin
Mac TV	4 MB	4, 5, 6, 8 MB	1, 2, 4 MB	80 ns	72 pin

Computer	RAM Soldered on Logic Board	Possible RAM Configurations	Possible Card Sizes	SIMM Speed
PowerBook 145B	4 MB	4, 6, 8 MB	2, 4 MB	100 ns
PowerBook 160, 165	4 MB	4, 6, 8, 10, 12, 14 MB	2, 4, 6, 8, 10 MB	100 ns
PowerBook 165c, 180, 180c	4 MB	4, 6, 8, 14 MB	4, 8, 10 MB	85 ns
PowerBook Duo 250	4 MB	numerous combinations up to 24 MB	4, 6, 8, 10, 12, 16, 20 MB	70 ns
PowerBook Duo 270c	4 MB	numerous combinations up to 32 MB	4, 6, 8, 10, 12, 16, 20, 24, 28 MB	70 ns
PowerBook Duo 280, 280c	4 MB	numerous combinations up to 40 MB	4, 8 MB from Apple; various third-party	70 ns
PowerBook 520, 540	4 MB	numerous combinations up to 36 MB	8 MB from Apple; various third-party	70 ns

VRAM Chart

This is a matrix of Macintosh computers and their VRAM requirements

Macintosh	On Board	VRAM Slots	RAM Speed	SIMM Size
Color Classic	256K	1	100 ns	256K
LC III	512K	1	100 ns	256K or 512K
LC 475	None	2	80 ns	256K or 512K
LC 520, 550	512K	1	80 ns	256K
LC 575	1 MB	2	80 ns	n/a
Quadra 605	0K	2	80 ns	256K or 512K
Quadra 610	512K	2	100 ns	256K
Quadra 650	512K	2	80 ns	256K
Quadra 660AV	1 MB	0	80 ns	n/a
Quadra 800	512K	2	80 ns	256K
Quadra 840AV	1 MB	4	80 ns	256K
Power Macintosh 6100/60*	n/a	n/a	n/a	n/a
Power Macintosh 7100/66*	1 MB	4	80 ns	128K x 8 bit
Power Macintosh 8100/80*	2 MB	4	80 ns	256K x 4 bit

- * Power Macintosh models utilize DRAM based video and are only upgradable with the VRAM Expansion Card installed. The Power Macintosh 6100/60 is not expandable.

Macintosh	On Board	VRAM Slots	RAM Speed	SIMM Size
Performa 400, 405, 410, 430	None	1	100 ns	256K or 512K
Performa 450	512K	1	100 ns	256K or 512K
Performa 460, 466	512K	1	100 ns	256K or 512K
Performa 475, 476	None	2	80 ns	256K or 512K
Performa 550, 560	512K	1	80 ns	256K
Performa 575, 577, 578	1 MB	2	80 ns	n/a

Macintosh to Performa Comparison Chart

This table compares each Macintosh Performa model with the corresponding Macintosh model. Macintosh Performa systems ship with modified system software, slightly different application software and hard drive bundles.

Performa System	Equivalent Macintosh System (with RAM/HDA/VRAM configurations)	Introduction Date
Performa 200	Macintosh Classic II, 4/80	9/19/92
Performa 400	Macintosh LC II, 4/80/512	9/15/92
Performa 405	Macintosh LC II, 4/80/256, Modem, .39 RGB	4/15/93
Performa 430	Macintosh LC II, 4/120/512, Modem, .39 RGB	4/15/93
Performa 450	Macintosh LC III, 4/120/512, Modem, .29 RGB	4/15/93
Performa 600	Macintosh IIvx w/out RAM cache, 4/160/512, FPU Socket	9/15/92
Performa 600CD	Macintosh IIvx w/out RAM cache, 5/160/1, CD300i, FPU Socket	9/15/92
Performa 410	Macintosh LC II, 4/80/512, Modem, .39 RGB	10/21/93
Performa 460	Macintosh LC III, 33 MHz, 4/80/512, Modem, .39 RGB	10/21/93
Performa 466, 467	Macintosh LC III, 33 MHz, 4/160/512, Modem, .29 RGB	10/21/93
Performa 475	Macintosh LC 475, 4/160/512, Modem, .29 RGB	10/21/93
Performa 476	Macintosh LC 475, 4/230/512, Modem, .29 RGB	10/21/93
Performa 550, 560	Macintosh LC 520, 5/160/768, Modem, CD, Trinitron	10/21/93
Performa 575	Macintosh LC 575, 5/250/1 MB, Modem, CD, Trinitron	4/26/94
Performa 577	Macintosh LC 575, 5/320/1 MB, Modem, CD, Trinitron	4/26/94
Performa 578	Macintosh LC 575, 8/320/1 MB, Modem, CD, Trinitron	4/26/94

Installation Procedures

DRAM and VRAM SIMM Installation

1. Remove the logic board and locate the SIMM socket(s).
2. Grasp the RAM or VRAM SIMM by the edges with the contacts pointing down. Insert the SIMM at an angle into the SIMM slot.
3. Push back on the SIMM until it snaps into place (see Figure 2-A).

Expansion Card Installation

Note

Low profile Macintosh computers (like the Quadra 610) require an adapter card connector to accommodate expansion cards into the slot.

1. Remove the top cover and port covers (if necessary) from back panel slot.
2. Grasp each end of the card and gently push the card into the slot as shown in Figure 2-B.

Quadra 610/AWS 60 CPU Replacement

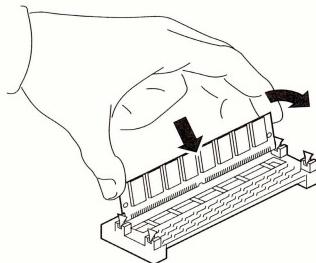
1. Remove the top cover, power supply, expansion card, and logic board.
2. Position the teeth of the removal tool in the groove between the chip and the socket (see Figure 2-C).
3. Lift up the handle to loosen each side of the processor chip, then remove.
4. Position the marked corner of the processor chip over the marked corner of the socket.
5. Press down firmly.

Color Classic Math Coprocessor Installation

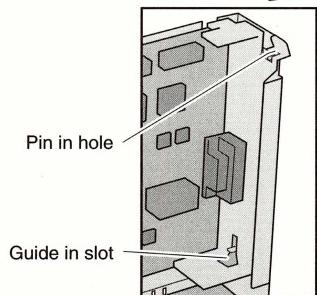
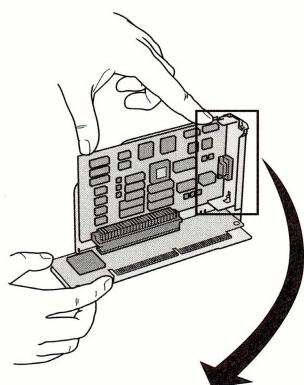
Installing the Motorola 68882 math coprocessor to the logic board increases overall system performance.

1. Remove the logic board.
2. Position the coprocessor over socket U9 with the beveled edge of the chip toward the large contact connector (J13) at the front of the board.
3. Align the pins in the socket and gently press down on the chip (see Figure 2-D).

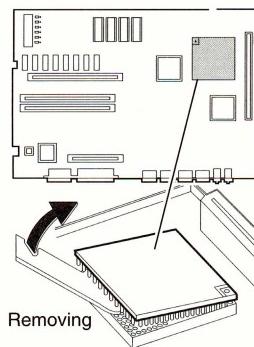
A Installing SIMMs



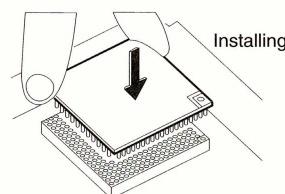
B Installing Expansion Cards



C Replacing Processor Chip



Removing



D Installing Classic Coprocessor

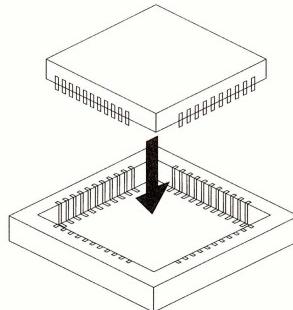


Figure 2 Installation Procedures

Power Macintosh System Overview

PowerPC microprocessors are a new family of processors built on reduced instruction-set computing (RISC) technology. RISC processors streamline the internal workings of computers. Whereas traditional (complex instruction-set computing, or CISC) processors contain a wide variety of instructions to handle many different tasks, RISC processors contain only those instructions that are used most often. When a complex instruction is needed, a RISC processor builds it from a combination of basic instructions.

RISC processors are designed to execute basic instructions extremely quickly. The performance gains achieved by speeding up the most-used instructions more than compensate for the time spent creating less-used instructions.

Three key points to remember about a PowerPC processor-based Macintosh system:

- It's a Macintosh
- It's compatible
- It offers tremendous performance

Apple's PowerPC processor-based models look, act, and feel like Macintosh systems. They have an identical user interface and require no retraining. Users can interact with the computer the same way they do today, whether they're copying a file or launching an application. Users can also mix RISC-based and 680x0-based Macintosh systems on the same network and exchange files and disks between them.

Existing 680x0 applications run on PowerPC processor-based Macintosh systems without modification via the LC680040 emulator. Many third-party companies, however, have developed new versions of their software that run in native mode on the Power Macintosh systems. Users can run both 680x0 and native PowerPC applications on the same Power Macintosh system simultaneously.

Compatibility is not limited just to applications. INITs, CDEVs, drivers, and other utility software also work on PowerPC processor-based Macintosh systems. So do AppleTalk devices (such as printers), SCSI devices (such as hard drives and scanners), ADB devices (such as mouse devices, trackballs, and keyboards), and other Macintosh cards and peripherals.

The primary operating system for PowerPC processor-based Macintosh computers is System 7. The operating system has been optimized, however, for highest performance on the PowerPC processor. This optimization of System 7 benefits applications written for 680x0 systems as well as those developed specifically for PowerPC processor-based systems.

And while PowerPC-based Macintosh systems running native applications offer two to four times the performance of today's fastest 68040- and 80486-based personal computers, the real promise of PowerPC technology is that it will enable Apple and other developers to deliver new software capabilities on Macintosh systems that are currently available only on high-end workstations.

The following chart shows which Macintosh system you can upgrade to the Power Macintosh platform. Upgrades are performed by either replacing the logic board or adding an upgrade card.

Macintosh Model	6100/60 or 6100/60AV Logic Board	7100/66 or 7100/66AV Logic Board	8100/80 or 8100/80AV Logic Board	Power Macintosh Upgrade Card
Quadra 900, 950				✓
Quadra 840AV			✓	
Quadra 800			✓	✓
Quadra 700				✓
Quadra 660AV	✓			
Quadra 650		✓		✓
Quadra 610	✓			✓
IIvx, IIvi, or Performa 600		✓		

Lithium Battery Verification

- ▲ Warning** If handled or discarded improperly, the lithium battery in the Macintosh computer could explode. In addition, the battery cannot be recharged. Attempting to recharge the lithium battery could cause a violent chemical reaction.

Take the following precautions when you store, handle, or dispose of lithium batteries:

- Inspect the integrity of battery wrappers and store the batteries in the same packaging or in a similar closed, heavy plastic bag.
- Store batteries in a designated, well-marked area with limited access.
- Do not allow battery leads or terminals to short-circuit.
- Do not dispose of batteries in a fire or incinerator. They may explode.
- Lithium is water reactive. Dispose of lithium batteries as hazardous waste. Place the dead battery in the air-tight wrapper and packaging that came with the replacement battery. Mark the package DEAD and return it to Apple. However, if the battery is physically damaged (for example, leaking), do not return it to Apple; dispose of the battery according to your local hazardous waste ordinances.

To verify a lithium battery, follow these steps:

1. Remove the battery (Figure 3-A). The Macintosh LC 575 and the Performa 575, 577, and 578 have a hook-and-loop attached battery. (See Figure 3-B for these systems.)
2. Set the voltmeter to the DC scale.
3. Hold the positive probe of the voltmeter to the battery and the negative probe to the negative end of the battery.
4. If the battery voltage is below 3.0 volts (3.2 volts for the Quadra 610, 650, 660AV, 800, 840, 840AV, 900, 950, AWS 60, AWS 95) replace the battery.

NiCad Battery Verification

This procedure applies to the PowerBook 145B, 165, 165c, and 180c.

1. Remove the battery.
2. Set the voltmeter to the DC scale.
3. Hold the positive probe of the voltmeter to the positive terminal and the negative probe to the negative terminal of the battery (Figure 3-C).
4. If the battery voltage is below 5.7 volts, recharge (first) or replace the battery.

Nickel-Metal-Hydride Battery Verification

This procedure applies to the PowerBook Duo and the PowerBook 520, 520c, 540, and 540c.

1. Remove the battery.
2. Set the voltmeter to the 20 volts DC scale.
3. Hold the positive probe of the voltmeter to the positive terminal and the negative probe to the negative terminal of the battery (Figure 3-C).
4. If the battery voltage is between 6 and 12 volts, recharge the battery. If the voltage is below 6 volts, replace the battery.

AC Adapter Verification

This procedure applies to the PowerBook 145B, 165, 165c, and 180c.

1. Plug the AC adapter into a wall socket.
2. Set the voltmeter to the 10 volts DC scale.
3. Hold the positive probe of the voltmeter to the inside of the AC adapter plug and the negative probe to the outside of the plug (Figure 3-D).
4. If the reading is not 7.5–7.9 volts, replace the adapter.

Duo AC Adapter Verification

1. Plug the AC adapter into a wall socket.
2. Connect the AC adapter plug to the PowerBook computer.
3. Set the voltmeter to the 20 volts DC scale.
4. Touch the negative voltmeter probe to the contact nearest the power plug and the positive probe to the contact second nearest the power plug (Figure 3-D).
5. If the reading is not 24-25 volts, replace the adapter.
6. Also check the AC adapter under load. Switch on the PowerBook and repeat the voltmeter check. If the reading drops more than 1-2 volts, replace the adapter.

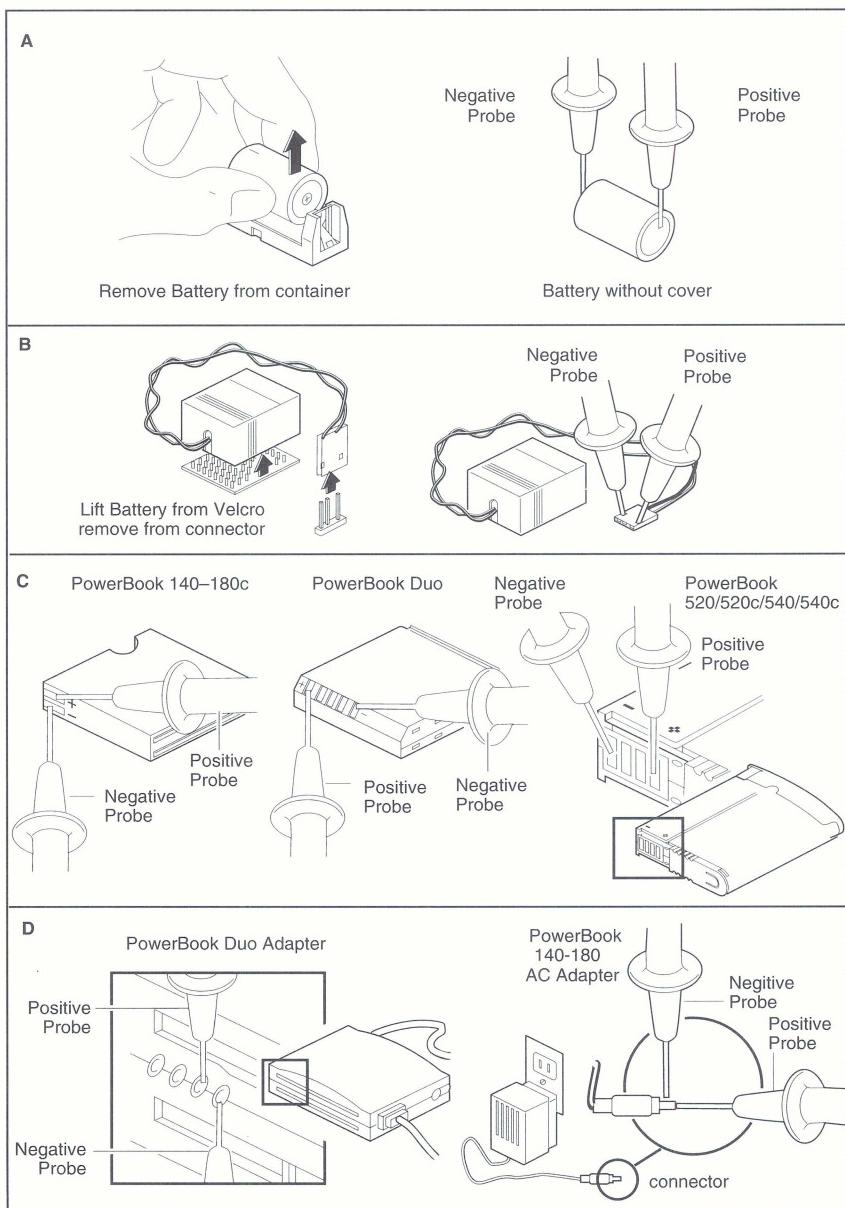


Figure 3 Battery and AC Adapter Verification

CTIA Module Symptom Codes

2

Apple adopted the CTIA Module Symptom Codes (MSC) in July 1994 to replace company-specific codes used previously. The industry association, CTIA, is sponsoring the use of these codes by all personal computer service providers.

When returning a defective module to Apple, always enter the symptom code that best describes the problem. If you are using the CTIA form, enter the six-digit CTIA code in the CODE field (see Figure 4) on the form.

Field

- 1 Enter the Operating System Code
- 2 Enter the Modifier Code
- 3-5 Enter the Observed Condition Code (three digit code)
- 6 Enter the Action Code

P A R T S	VENDOR PART #	QTY	DESCRIPTION	Field			PO #
				1	2	3	
	1.						
	2.						
	3.						

Figure 4 CTIA Failure Code Reference

AppleOrder, the electronic order management tool, implements the CTIA failure codes in a four-digit format. Select an Observed Condition Code and a Modifier Code by pointing and clicking the mouse on the symptom that best describes the problem. These codes will be displayed in the "Observed Condition" field on the AppleOrder 3.0 form (see Figure 5).

SELECT PART	DESCRIPTION	EXCH PRICE	QTY	OBSERVED CONDITION
1. 661-0733	LGC BD, 16MHZ, MAC COLOR CLASSIC	238.500	1	501-C
2. 661-0763	MOUSE II, DESKTOP BUS	56.700	1	406-C
3.				
4.				

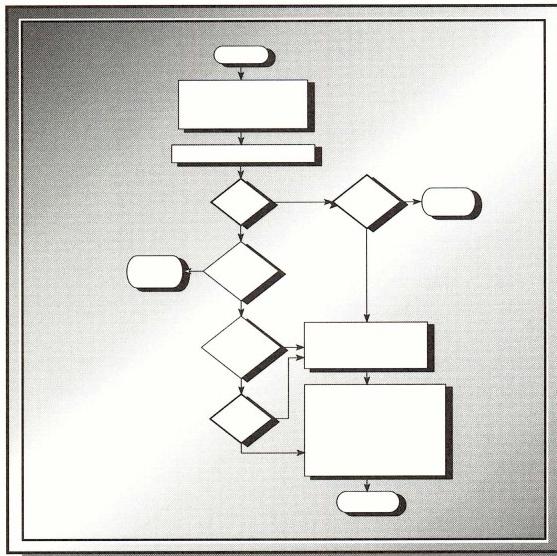
Figure 5 AppleOrder 3.0 Failure Code Reference

The Apple SRO form also implements the codes in a four digit format. If you are using the SRO form, write the three-digit Observed Condition Code followed by a one-digit Modifier Code in the "Repair Confirmation Code/Symptom Code" section on the form.

OPERATING SYSTEM CODE		Display
Description	Code	
Not applicable	A	No video 201
DOS	B	Unstable video (jitter/flicker) 202
Windows	C	Focus/convergence 203
Windows NT	D	Poor resolution 204
OS/2	E	No back light 205
UNIX	F	Color(s) missing 206
Apple II	G	Pin cushioning 207
Macintosh	H	Horizontal/vertical bright lines 208
Novell	I	Rolls vertically 209
Banyan	J	Diagonal stripe 210
		Fan not spinning 211
		Distorted sound 212
		Cannot adjust contrast 213
MODIFIER CODE		
Description	Code	
Not applicable	A	Random characters on display 214
Continuous	B	Dim or low intensity 215
Intermittent	C	Incorrect picture size/alignment 216
Fails after warm up	D	Won't show 2nd monitor 217
Environmental	E	
Configuration - Peripheral	F	Drives, Internal or External
Damaged	G	Noisy 301
		Will not spin 302
		Read/write error 303
		Format error 304
ACTION CODE		
Description	Code	
Return	A	ID error 305
Adjust	B	Lost records 306
Reseat	C	Bad sectors 307
No action	D	Drive will not mount 308
Reload	E	Not recognized w/ utility or formatter 309
Configure	F	Will not accept disk 310
		Disks do not work in another drive 311
		Will not boot, reads & writes OK 312
OBSERVED CONDITION CODE		
Description (Generic)	Code	Input Devices
Good part	101	Keyboard locks up 401
No power/power light	102	Sticky key 402
Will not boot from hard disk drive	103	Inoperative key 403
Mechanical	104	Incorrect key code 404
Damaged	105	Foreign substance spilled on unit 405
System hangs up	106	Pointing device not tracking properly 406
Intermittent	107	Jittery/intermittent 407
Cosmetic	108	Mechanical failure 408
Screen bright, no Mac face	109	Bad cord/cable 409
Reset problem	110	Locks up system 410
Hibernation/sleep problem	111	No response, logic board OK 411

Boards			
Memory error	501	Print quality (include sample)	701
Keyboard/pointing device error	502	Paper handling	702
Hard drive error	503	Accessories	703
Floppy drive error	504	Overheating	704
Video error	505	PCB	705
Tape drive error	506	Scanner	706
Network card error	507	Communications	707
Communications error	508	Software	708
Configuration error	509	No power light	709
Parallel ports	510	Improper print head movement	710
Serial ports	511	Select button inoperable	711
Set up	512	Fails self test	712
Wrong beeps/startup tone	513	Indicator lights suggest fault	713
Emulation	514	Printer not seen by CPU	714
Bad expansion slots	515	Self test OK, won't print from host	715
Audio input not functioning	516	Prints blank or black pages	716
Audio output not functioning	517		
Battery failure	518		
Inoperative control panel	519	Multifunction Device	
Dark screen with startup tone	520	Accessories	801
Sad Macintosh	521	Configuration	802
Cannot shutdown	522	Consumables	803
Known good mouse/paddle not working	523	Engine error/fault	804
Bad or no color, monochrome OK	524	Facsimile	805
Will not run off AC power	525	Other applications	806
Power Supply		Paper handling (print scan)	807
Overheat (fan problem)	601	PCB	808
Random reset	602	Print/scan/ image quality (include sample)	809
Voltage missing	603	Software	810
Noise/hum	604	System environment	811
Crowbar/chirping	605	Docking problem	812
Blows fuses	606	Modems	
Causes system failures	607	Self test fails	901
UPS battery replacement indicated	608	Communications failures	902
UPS power-on indicator not lit	609	Will not dial	903
		Will not answer	904
		Stuck off hook	905
		Locks up	906

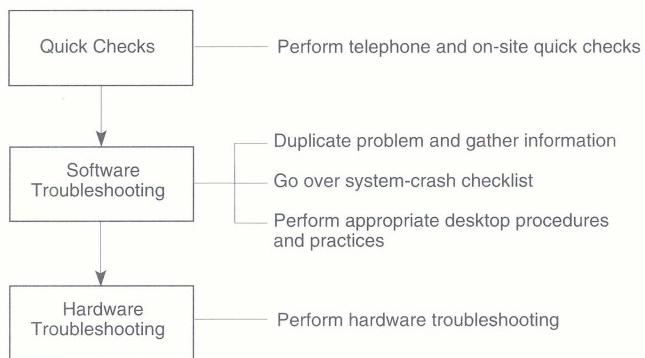
General Troubleshooting



Initial Troubleshooting	34
Software Troubleshooting	35
System Enablers	39
Preparing to Install System 7.1	
Software	42
Installing System 7.1 Software	46
System 7 Pro	48
Apple Software Restoration CD	51
Hardware Troubleshooting	52
Startup Problems – Flowcharts	54
MacTest Pro	60
Apple Personal Diagnostics	64

Initial Troubleshooting

Overall Approach



Telephone and On-Site Quick Checks

- ✓ Check the power source and power connection.
- ✓ Check all cables and cable connections.
- ✓ Check the adjustment of all user controls.
- ✓ Check that not more than one System file is on the startup device/disk.
- ✓ Check that the computer system and the system software are compatible.
- ✓ Open the computer and verify that all circuit boards, fuses, and chips are secure, clean, and undamaged.

Information Gathering

When quick checks do not identify the problem, try duplicating the problem, and gather as much information about the problem as possible. Take special note of the following:

- Operating condition of the system when the problem occurs (application and version, system software and version, whether networked, system configuration, peripherals, INITs, CDEVs, DAs, etc.)
- Exactly what your customer is doing when the problem occurs
- What happens to the system (freezes, crashes, displays error message)
- What your customer has tried to do to fix the problem, and the outcome
- If the problem appeared recently, note what your customer recently changed or added to the system

Using this information, perform appropriate solutions from the following System-Crash Checklist. If this systematic approach does not fix the problem, your customer probably has a hardware problem (refer to "Hardware Troubleshooting" later in this section).

Software Troubleshooting

System-Crash Checklist

- ✓ Check whether the problem is peculiar to one application (try replicating the problem using another application). If the application is at fault, consult the following chart for suggestions.

Problem	Solutions
Program incompatible with system software	<ol style="list-style-type: none">1. Contact vendor about program update.2. Remove program from system.
Program corrupted	<ol style="list-style-type: none">1. System crashes can corrupt program and system software. Remove program.2. Reinstall program and system software from original disks.3. Reinstall system software.
Insufficient memory to run program	<ol style="list-style-type: none">1. Close other applications and restart program. (You may have to restart system.)2. Allocate more memory to application. Select application, select Get Info from menu bar, and increase allocated memory in dialog box.3. If applicable, check RAM cache. If cache is set too high, computer diverts some RAM for system use, thus reducing RAM available for programs.4. Turn on Virtual Memory.5. Install additional RAM.
Message “Application is busy or missing” displays	<ol style="list-style-type: none">1. Make sure application is present on drive.2. Make sure document was created with same version of application as application on drive.3. Launch application first; then open document from application.4. Rebuild desktop.5. Reinstall application.6. Run a utility program, such as Norton Utilities, that resets corrupted bundle bits.
Programs (especially DAs, INITs, and CDEVs) conflict	<ol style="list-style-type: none">1. Run Compatibility Checker before installing System 7. Remove or update any questionable INITs or CDEVs.2. If program was added just prior to problem, remove offending program.3. Remove all DAs, INITs, and CDEVs, and replace one at a time until offender is found.

- ✓ Check whether the problem is with system software (boot from a floppy) or with multiple system folders (use Find command).

Problem	Solution
Multiple system folders	<ul style="list-style-type: none"> – Remove all system folders except folder with Macintosh icon on it (see Desktop Procedures and Practices).
Corrupted system software	<ul style="list-style-type: none"> – Replace system software. (When replacing corrupted system software, avoid introducing new problems. Always use Installer on original system software disks; do not use System 6 Installer with System 7. If you remove System file before running Installer, you must replace fonts and desk accessories. Make copies of your customer's fonts and desk accessories before running Installer. For more information, refer to Replacing the System File under Desktop Procedures and Practices.

Desktop Procedures and Practices

Identifying and remedying problems that may be software related requires familiarity with basic desktop management procedures and practices. An inappropriately managed desktop could cause the following problems.

Booting With Extensions Off

- Symptoms: Applications quit unexpectedly or freeze at any time. Machine may even hang up when idle.
- Occurs: If an extension or control panel is not compatible with the system software (or with another extension or control panel) the machine may exhibit erratic behavior.
- Remedy: Disable all extensions and control panels temporarily.
- Procedure: Hold down the shift key before the Welcome to Macintosh message appears.

Multiple System Folder Problems

- Symptoms: System crashes; unusual error messages; font and DA lists change unexpectedly.
- Occurs: When disks containing system folders are dragged onto system or system software is loaded without using Installer.
- Remedy: Locate and remove all system folders without the Macintosh icon on the folder; also remove any extra System or Finder files.
- Procedure: Boot from known-good system disk, use the Find command to locate and remove multiple system folders, and reboot computer.

INIT and CDEV Conflicts

This problem is very common under System 7. Be sure to run the Compatibility Checker before installing System 7. Remove any questionable INITs or CDEVs (or update them with newer versions and rerun the Compatibility Checker).

- Symptoms: System crashes and myriad of other problems.
- Occurs: When an INIT or CDEV conflicts with an application on system.
- Remedy: Locate and remove all INITs and CDEVs, and then replace them one at a time until the conflict returns.
- Procedure: Place all INITs and CDEVs in a separate folder within System Folder (this prevents INITs and CDEVs from loading when you boot the system), and return each INIT and CDEV to the System Folder one at a time. (Renaming an INIT, such as adding a prefix of "Z" so it loads last, may remedy the conflict.) Turn off INITs before you install new software.

RAM Cache Out-of-Memory Problems

RAM cache is a feature that speeds up operation of the system. The RAM cache acts as a special RAM buffer between applications and drives. From 32K to 768K of the most frequently used blocks of data can be stored in the RAM cache, which can significantly increase speed within an application and cause applications to launch from and return to the Finder more quickly. Memory problems can occur when the RAM cache is set too high.

- Symptoms: Insufficient memory problems; applications won't run; degraded system performance; ID=28 system bombs in systems configured with 1 MB or less of memory.
- Occurs: When RAM cache is set too high (available system memory is insufficient to run program).
- Remedy: Switch off RAM cache or reduce amount of memory allocated to RAM cache.
- Procedure: Open Memory control panel and reduce RAM cache allocation as desired. Reboot system.

Rebuilding the Desktop / Slow Finder

- Symptoms: Finder cannot locate applications that are on disk drive, or Finder is slow.
- Occurs: When disk is overloaded with applications and icons, or applications contain excessive number of file comments.
- Remedy: Rebuild desktop file (which erases comments from Get Info comment box of all applications on drive).
- Procedure: Hold down Option and Command keys while booting. Click on OK when asked if you want to rebuild the desktop.

Resetting Corrupted Parameter RAM

- Symptoms: Macintosh does not boot from internal hard drive, a serial device (modem, printer) is not responding, or error message that port is already in use.
- Occurs: When an application crashes, it sometimes executes code that corrupts parameter RAM (PRAM). PRAM contains information required by the Macintosh operating system (OS) to start up from an internal SCSI drive, as well as other OS information.
- Remedy: Reset PRAM to its default value.
- Procedure: Hold down Option, Command, P, and R keys during startup but before "Welcome to Macintosh" appears.

Updating Your Hard Drive Software

- Symptoms: System does not recognize or boot from hard drive.
- Occurs: When startup instructions (boot blocks) on the hard drive are damaged or the hard disk driver is damaged.
- Remedy: Replace the hard disk driver.
- Procedure: Boot the computer from a startup disk that contains an appropriate hard disk setup program. (For Apple hard drives, use the *Apple HDSC Setup* program found on a *Macintosh Disk Tools* disk.) Install or update the hard disk driver on the hard drive.

Removing and Preventing Viruses

- Symptoms: Unexplained system crashes; corrupted or disappearing files.
- Occurs: After using a disk or program that is infected by a virus (often contracted from shareware found on electronic bulletin boards).
- Remedy: Use an antivirus program to eradicate the virus, and practice virus prevention in the future.
- Procedure: Boot the computer from a startup disk that contains an antivirus application and launch the eradication program. There are several effective antivirus programs, including *Disinfectant* by John Norstad, *Interferon* and *Virex* by Robert Woodhead, and *SAM* from Symantec.
- Prevention: Many of the antivirus applications include programs for screening inserted disks for known viruses—use them! Also, master disks should be locked; applications can be protected by locking them using the Get Info box. Be sure the virus utility is System 7 compatible. Incompatible versions can cause unexpected problems that are difficult to track down.

System Enablers

System enablers are software modules, specific to a given CPU (hardware model). A system enabler overrides system resources at startup to allow existing system software to support new Macintosh models. This mechanism eliminates the need to release CPU-specific system software each time a new Macintosh model is released. System Enablers are located at the top level of the System Folder — not in the Extensions folder.

The System 7.1 base system has built-in support for all Macintosh models that shipped before the release of System 7.1 (from the Macintosh Plus through the Macintosh Quadra 950 and PowerBook 145). All new Macintosh models shipping after the release of System 7.1 will include System Enabler software specific for that model or a particular family of models, such as the Macintosh PowerBook family.

System enablers replace the release strategy that Apple used in the past for minor system changes needed for new hardware. The old strategy was to release a new version of the system software, such as version 6.0.8 or 7.0.1. With enablers, the differences in hardware no longer require a new system release, but instead each new computer has its own enabler (if necessary) to make the system work for that hardware. Enablers reduce user confusion and unnecessary upgrades. In the past, every time a computer was released with its corresponding new software , users of older computers were unsure if they needed to upgrade to the new system software. Many assumed that since it was newer, it was better. This usually wasn't the case. For instance, upgrading from 7.0 to 7.0.1 on a Macintosh IIcx, gives you nothing new.

Apple will continue to use system extensions or components to add new functionality across the product line, as with QuickTime and Macintosh Easy Open.

Some General Rules About Enablers

System enablers are system software, designed and intended solely for the use of Apple Computer. Their functionality and implementation will change. An enabler is essentially an extension to the System file.

If there are multiple enablers in a System Folder, the system will use only one of them. The system software (System file plus enabler) is responsible for arbitrating which enabler is used on a specific computer. It looks at the computer type it's currently running on, the computers that the enabler supports, and some enabler-internal applicability flags. Note that this is how the decision is currently made; as enablers are used for more computers and in different situations, more variables may be added to the decision process.

System Enabler Versions

System enablers are required for the Macintosh models indicated below with System 7.1 or later. Macintosh computers that require system enablers will not operate properly with System 7.0.1 or earlier. The Plus, SE, SE/30, Classic, Classic II, LC, LC II, Mac II, IIx, IIcx, IIsi, IIfx, PB 100/140/145/170, Quadra 700/900/950, Performa 200/400/405/410/430 do NOT need a system enabler.

This chart shows the appropriate system enabler for the indicated Macintosh computer. You can find the enablers on the Appletalk network (Path: Software Sampler, Apple SW Updates, Macintosh, Supplemental System Software, System Enablers).

Macintosh	Enabler	Version
Macintosh Centris 610	System Enabler 040	1.1
Macintosh Centris 650	System Enablers 040	1.1
Macintosh Centris 660AV	System Enabler 088	1.1
Macintosh Color Classic	System Enabler 401	1.0.5
Macintosh IIvi	System Enabler 001	1.0.1
Macintosh IIvx	System Enabler 001	1.0.1
Macintosh LC III	System Enabler 003	1.0
Macintosh LC 475	System Enabler 065	1.1
Macintosh LC 520	System Enabler 403	1.0.2
Macintosh LC 575	System Enabler 065	1.1
Macintosh PowerBook 160	System Enabler 131*	1.0.2
Macintosh PowerBook 165	System Enabler 131*	1.1
Macintosh PowerBook 165c	System Enabler 131*	1.0.3
Macintosh PowerBook 180	System Enabler 131*	1.0.3
Macintosh PowerBook 180c	System Enabler 131*	1.0.3
Macintosh PowerBook 520	500 Series Enabler†	1.0
Macintosh PowerBook 520c	500 Series Enabler†	1.0
Macintosh PowerBook 540	500 Series Enabler†	1.0
Macintosh PowerBook 540c	500 Series Enabler†	1.0
Macintosh PowerBook Duo 210	System Enabler 201†	1.0
Macintosh PowerBook Duo 230	System Enabler 201†	1.0
Macintosh PowerBook Duo 250	PowerBook Duo Enabler†	1.0

Macintosh	Enabler	Version
Macintosh PowerBook Duo 270c	PowerBook Duo Enabler†	1.0
Macintosh PowerBook Duo 280	PowerBook Duo Enabler†	1.0
Macintosh Quadra 605	System Enabler 065	1.1
Macintosh Quadra 610	System Enabler 040	1.1
Macintosh Quadra 650	System Enabler 040	1.1
Macintosh Quadra 660AV	System Enabler 088	1.1
Macintosh Quadra 800	System Enabler 040	1.1
Macintosh Quadra 840AV	System Enabler 088	1.1
Macintosh TV	System Enabler 404	1.0
Performa 600	System Enabler 304	1.0.1
Performa 450, 460, 466, 467	System Enabler 308	1.0
Performa 475, 476	System Enabler 364	1.1
Performa 550	System Enabler 332	1.1
Performa 575, 577, 578	System Enabler 364	1.0
Power Macintosh 6100	PowerPC Enabler	1.0
Power Macintosh 7100	PowerPC Enabler	1.0
Power Macintosh 8100	PowerPC Enabler	1.0

* System Enabler 131 replaces System Enabler 111 and System Enabler 121.

† Express Modem users should install the Duo Battery Patch (Extension) which is available on the AppleLink network.

Preparing to Install System 7.1 Software

This section takes you through all preparation, installation, and post-installation steps you should take to properly install system software version 7.1 on a Macintosh computer.

Print and read the Read Me file, located on the Tidbits disk inside the Apple Utilities folder. This file contains current information on System 7.1. Also, system disks supplied with Macintosh computers come with an Install Me First disk. If you have this disk, follow the instructions on it.

If you don't have an Apple hard drive, or if you used third-party software to format your hard drive, verify that the formatting software is compatible with System 7.1. Contact the software developer.

System software version 7.1 requires a Macintosh computer with at least 2 MB of RAM (4 MB of RAM is strongly recommended), and a hard disk with at least 5 MB of disk space available.

You can install over System 6 or System 7, or on a hard drive that doesn't have a System Folder. The Installer can't install on a hard drive with System 5 or earlier. If you have System 5 or earlier, it's important to follow the instructions for a clean installation.

Back Up Your Hard Drive

Back up your entire hard drive. If this isn't possible, at least make a backup copy of your System Folder.

1. Click the System Folder once to select it.
2. Select Duplicate from the File menu or press Command-D.
3. Save the duplicate System Folder to another hard drive or to floppy disks.

Disable Virus and Security Software

1. Select Control Panel from the Apple menu.
2. Double-click the security software icon (for example, Empower or MacPassword).
3. Turn off the security software.
4. Close the security software window.
5. Close the control panel window.
6. Double-click your System Folder to open it.
7. If you have Symantec Antivirus for the Macintosh (SAM) installed, drag SAM Intercept and SAM Virus Definitions out of your System Folder.

Prepare for a Clean Installation

1. Start up from the Disk Tools disk. If the computer ejects the Disk Tools disk and won't start up from it, be sure you have an Apple SuperDrive. If your computer doesn't have a SuperDrive, you need System 7.1 on 800K disks. To get these disks, call the Apple Assistance Center at (800)767-2775.
2. Double-click your hard drive icon to open it.
3. Double-click your System Folder to open it.
4. To retain some of the fonts and desk accessories you've installed, you'll have to remove them from the current System file. Double-click the System file and drag the fonts and desk accessories out.
5. Select the Finder file within the System Folder.
6. Hold down the Shift key, scroll down, and select the System file.
7. Drag the Finder and System files to the Trash.
8. Emptying the trash should wait until installation is successful, in case anything goes wrong. These files are harmless in the trash.
9. Close the system folder's window.
10. Click on the system folder's name to highlight it.
11. Type the word "storage" and press the Return key.

Remove Unnecessary and Incompatible Files

If you have the Tune-Up file in your system, delete it from the Extensions folder within the System Folder. The System 7.1 Installer doesn't remove Tune-Up, and removing it saves disk space. System 7.1 includes Tune-Up enhancements.

MODE 32 and MacTCP 1.1 and earlier versions aren't compatible with System 7.1. If you have these installed, remove the files from the Extensions folder. You can use the 32-bit system enabler with System 7.1 instead of MODE 32.

Check Available Hard Drive Space

Be sure you have at least 5 MB of disk space available on the hard drive where you're installing the system software. Double-click on the hard drive icon, and choose **by Icon** from the View menu. The upper-right corner of the window displays the amount of available disk space. If there's less than 5 MB available, you'll need to delete some files. Copy files to floppy disks if you need to, then drag them to the Trash, and empty the Trash.

Check Compatibility

If you're upgrading from an earlier version of System 7 to 7.1, check the Software Compatibility list or run Compatibility Checker 2.0.

Run Disk First Aid

Disk First Aid is a utility that verifies the directory structure of any hierarchical file system (HFS) based storage volume. Many hard drives, floppy drive, and compact disc (CD) drives are HFS-based storage volumes.

If imperfections are found within a volume, you can use Disk First Aid as a "first step" to repair the defects. If a volume has suffered several corruptions, you may need to use other utility programs or repair methods.

Be sure you followed the instructions under "Disable Virus and Security Software" earlier in this section, before you begin.

1. Startup with the Disk Tools disk. The Disk Tools disk icon appears in the upper-right corner of the desktop. If it doesn't appear there, select Restart from the Special menu. When the disk ejects, push it back into the drive immediately.
2. Double-click the Disk Tools icon to open it.
3. Double-click the Disk First Aid icon.
4. Click the Drive button to select your first hard drive. Click the Open button.
5. Click the Start button. If there are no problems, and you want to check other disks, choose Close from the File menu and then choose Open. Select another drive. If a drive is damaged, click the Repair button. If repairs are unsuccessful, you'll need to back up the drive, then reinitialize the drive with HD SC Setup.
6. Choose **Quit** from the File menu.

Update Hard Disk Drivers

Drivers are small bits of information that tell your hard drive how to interact with your Macintosh computer. You must update these drivers on an Apple hard drive before installing System 7.0 or higher.

Before updating drivers, be sure you followed the instructions under "Disable Virus and Security Software" earlier in this section.

1. Startup with the Disk Tools disk. The Disk Tools disk icon appears in the upper-right corner of the desktop. If it doesn't appear there, select Restart from the Special menu. When the disk ejects, push it back into the drive immediately.
2. Double-click the Disk Tools icon to open it.
3. Double-click the Apple HD SC Setup icon.
4. Click the Update button in the dialog box that appears. If the update is successful, it will display the message "Driver Update Successfully Completed." If the Update button is dimmed, no update is required.
5. Click the Quit button.

Installing System 7.1 Software

System 7.1 software consists of either:

- A set of nine 800K disks: Disk Tools, Install, Install 2, Install 3, Printing, Fonts, Fonts 2, Tidbits, and Tidbits 2, or
- A set of six 1.44 MB (high density) disks: Disk Tools, Install, Install 2, Printing, Fonts, and Tidbits.

To install System 7 software, follow these directions:

1. If you're installing from 1.44 MB disks, start your Macintosh computer from the Install disk.

If you're installing from 800K disks, start up from the Disk Tools disk. Then eject the Disk Tools disk and insert the Install disk. Since the 800K Install disk doesn't contain a System file, you can't use it as a startup disk. You'll have to swap between the Disk Tools and Install disks 4 to 6 times before the Installer begins.

2. When the welcome message appears, click the OK button. The Easy Install window appears. Select one of these two available options:
 - Easy Install, which installs the Macintosh system software and printer software recommended for your computer, or
 - Customize Install, which lets you override the recommended software and choose the software you want installed.

Note

For Macintosh Quadra, PowerBook, and LC users: When installing System 7.1 on the Quadra 700, 900, and 950; Macintosh LC and LCI; and PowerBook 100, 140, and 170 computers use the Easy Install option or choose **System software for any Macintosh** in the Custom Install window. DON'T use Custom Install for other software choices—the Monitors control panel won't install properly if you use this option.

Easy Install

1. Click the Switch Disk button to select the disk you want to install with system software.
2. Click the Install button to do the Easy Install.
3. Follow the instructions on the screen. Messages appear, prompting you for the proper disks. When installation finishes, a dialog box appears.
4. Click the Quit Button.
5. Select Restart from the Special menu.

Customize Install

1. Click the Customize button.
2. When a window appears, click the Switch Disk button to select the disk you want to install with system software.
3. Select the items you want to install. Press the Shift key, and click to select multiple items. Your selections appear beneath the scrolling window.
4. When you've made your selections, click the Install button. Messages appear, prompting you for the proper disks. You'll see a message telling you that installation is complete.
5. Click the Quit button.

Net Install

If someone has previously set up the network, you can install System 7.1 over a network:

1. Connect to the shared disk that contains the Net Install folder.
2. Open the Net Install folder.
3. Double-click the Installer icon.
4. Follow the instructions under "Easy Install" or "Customize Install," which appear earlier in this section.

After Installation is Complete

If you want to use the fonts and desk accessories that were installed in your old System file, drag the font files to the new System Folder on your hard drive. The system will automatically place the fonts into the Font folder. Drag the desk accessories to the Apple Menu Items folder.

If you installed any software that modified your old System file, you need to reinstall that software after you install System 7.1. Delete the old System file from the desktop. The Installer program doesn't install QuickTime automatically. Use the QuickTime disk to install the QuickTime extension.

If you need to create an empty suitcase, duplicate an existing suitcase. Drag the contents of the duplicated suitcase to the Trash. You can duplicate the remaining suitcase whenever you need one.

System 7 Pro

System 7 Pro doesn't replace System 7.1—it enhances the functionality of the base system software release. System 7 Pro provides the following software in one package:

- System 7 version 7.1.1
- PowerTalk 1.0 (AOCE collaboration services for individuals)
- AppleScript 1.0 (runtime and script editor)
- QuickTime 1.6.1 (Apple's multimedia technology)

System 7 Pro has all the features of System 7 including:

- Fast access to files and applications with Finder tools such as Find, the Apple Menu, and aliases
- Publish and Subscribe functions for automatic updating of documents
- Support for Apple TrueType technology
- One-button installation

You can install System 7 Pro in any Macintosh computer with 4 MB of RAM (5 MB of RAM is recommended), a hard drive, and an Apple SuperDrive. System 7 Pro doesn't run on the Macintosh 128, Macintosh 512, Macintosh Plus, or Macintosh XL.

If you already have System 7 software installed on your disk, the System 7 Pro Installer will update it, leaving your existing fonts, desk accessories, extensions, and so on untouched.

PowerTalk

PowerTalk allows you to correspond and work with others using built-in mail and collaboration services. Use your modem or an AppleTalk network to send messages of any type — including text, images, video, and sound — to other System 7 Pro users.

With PowerTalk, you can send items from your desktop by dragging and dropping the item to be sent onto an information-card icon for the recipient. You use this same method whether you're sending the item to other PowerTalk recipients or using access software provided by other vendors to reach fax or other electronic-mail destinations.

Incoming mail items arrive in a single universal desktop mailbox directly on the Macintosh desktop. You can open items, copy them to folders, and otherwise manipulate them as you would any other desktop objects.

PowerTalk also lets you create catalogs of information that facilitate your collaboration with others, from simple address lists to collections of images or sounds.

PowerTalk has a “key chain” that lets you protect and access your mailbox, AppleShare volumes, and other services using a single access code. Commercial-grade electronic-signature support is provided via PowerTalk’s DigiSign software.

PowerTalk features:

- Exchange mail with other PowerTalk users without a server or system administrator.
- Send items with a “drag and drop” of desktop icons.
- Send a single document over multiple delivery mechanisms (fax, electronic mail, and so on) with a single command.
- Use PowerTalk catalogs to organize the information you refer to most often when collaborating with others.
- Implement basic mail services with the AppleMail letter application, which supports text, images, video, and sound.
- Protect your mailbox and other PowerTalk services with a single access code.
- Use DigiSign software to approve documents electronically.
- Use PowerTalk-savvy applications to further automate and extend your messaging capabilities.
- Obtain additional authentication and encryption capabilities with optional PowerShare servers.
- Receive mail from multiple sources in a single desktop mailbox, with an In Tray for viewing and organizing all kinds of correspondence sent to you and an Out Tray for viewing the correspondence you’ve sent.

AppleScript

AppleScript is a system-level “macro” language that lets you invoke pre-scripted automated tasks.

AppleScript features:

- Automate routine tasks.
- Create custom solutions using off-the-shelf AppleScript-savvy applications.
- Use a consistent scripting language across all AppleScript-savvy applications.

QuickTime

QuickTime is Apple's multimedia technology. It lets you view, copy, and paste video, animations, images, and sound as easily as you manipulate text.

QuickTime features:

- Enables you to edit and play back QuickTime movie files.
- Uses a cross-platform file format that allows playing back Macintosh QuickTime files on Microsoft Windows systems using QuickTime for Windows.
- Offers built-in ability to compress video, animation, and still-image files to a fraction of their original size.
- Supports Kodak's PhotoCD format.
- Lets you import audio files from CDs using an AppleCD 300 or 300i CD-ROM drive and add them to QuickTime movies using the QuickTime standard file-preview dialog box from any QuickTime-compatible application.
- Supports PowerBook systems that have 16-level gray-scale display.

Apple Software Restoration CD

The Apple Software Restoration CD products help Service technicians quickly and accurately restore system software and market-bundled applications on systems they are repairing or upgrading.

Each CD includes these features:

- CD with the capability of booting the system
- At Ease interface
- A variety of Apple disk utilities (such as Disk First Aid and HD SC Setup)
- A familiar Installer interface for restoring software to a drive the user chooses
- Fast installation
- Easy-to-follow user's guide
- An on-line Read Me file
- Compatibility with AppleCD SC Plus, AppleCD 150 and AppleCD 300

3

Apple Software Restoration CD System Software

This product provides software and installers that allow technicians to restore the original system software that shipped on an Apple computer, peripheral, printer, or networking card. Included on this CD is the necessary software for initializing, updating, and repairing hard drive directories.

This CD is available by subscription only and will be updated quarterly or as often as Apple determines is necessary. Each update in this subscription program will replace the previous version of the CD.

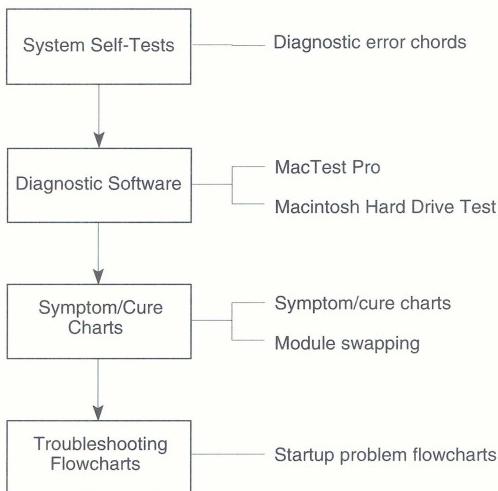
To order the System Software CD (part number: 077-8000), contact the Apple Customer Service Center at 800-919-2775.

Apple Software Restoration CD Market Software Series Volumes 1 and 2

This product provides software and installers for technicians to restore the original system software that shipped on computers offered through specific market or channel programs since October, 1992. Use this tool during the repair process to restore system software and third-party bundled applications.

Volume 1 contains the system software and third-party applications included on Consumer Channel configurations. Volume 2 contains K-12/HIGHER Education configurations. Both volumes also contain software for initializing systems with HD SC Setup and for updating and repairing hard drive directories. This CD isn't subscription-based, but is available for individual purchase.

Isolating a Hardware Problem

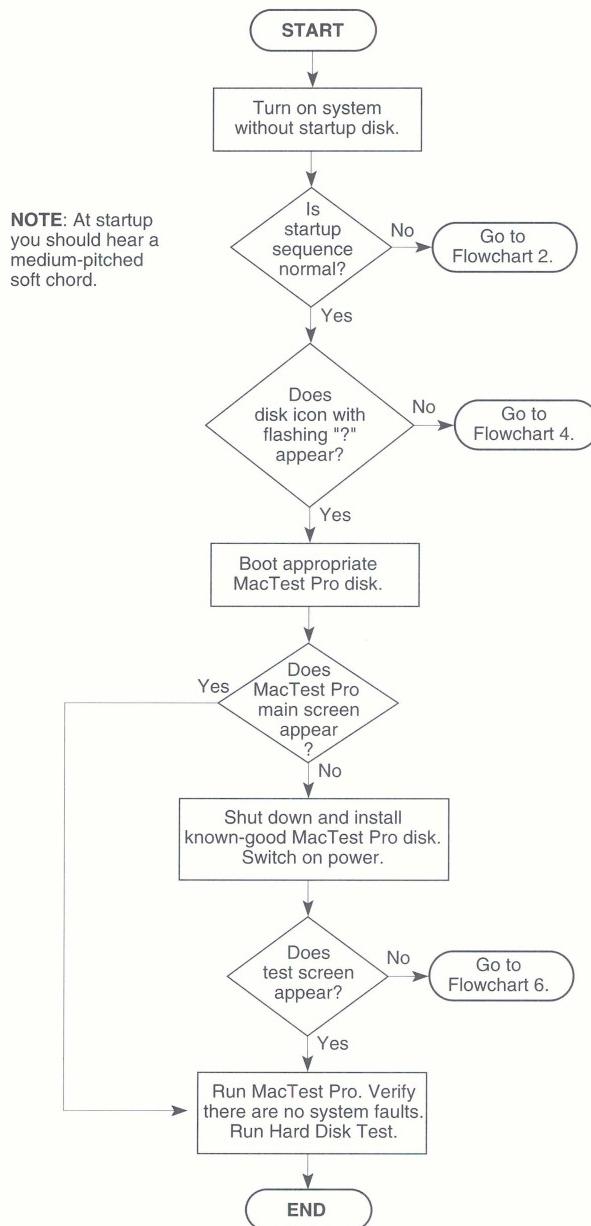


- **System Self-Tests**—Start up the customer's system, listen for diagnostic error chords.
- **Diagnostic Software**—If the system passes the self-tests but the problem persists, try running the appropriate MacTest Pro program. If you suspect a hard drive problem, you should also run the Macintosh Hard Drive Test program.
- **Symptom/Cure Charts**—If the customer's system (or MacTest Pro) does not boot or MacTest Pro fails to find the problem, refer to the symptom/cure charts in the section that covers your customer's computer. If you think you recognize the problem and you have the necessary replacement module with you, try module swapping.
- **Troubleshooting Flowcharts**—If the customer's system (or MacTest Pro) does not boot or MacTest Pro fails to find the problem and the problem is not clearly defined or not listed in the symptom/cure charts, refer to "Startup Problems—Flowcharts" in this section. These flowcharts present a step-by-step procedure for isolating the problem.

Hardware Troubleshooting Guidelines

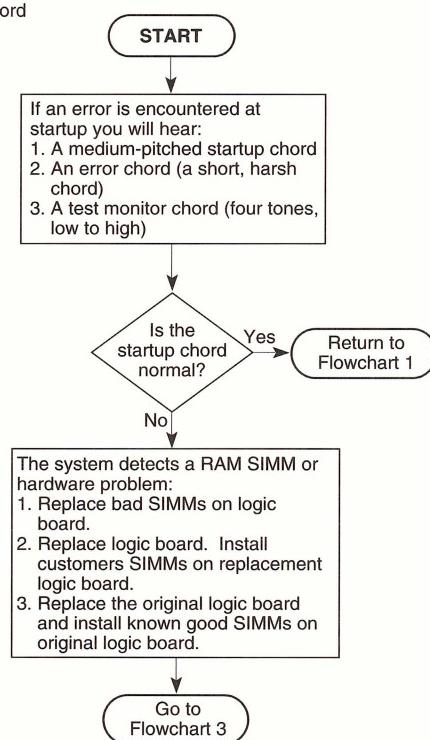
1. Use only known-good test equipment and diagnostic programs.
2. The troubleshooting tools are designed to test a system in its minimum configuration. Disconnect external peripherals and remove all NuBus cards. After verifying that the computer is fully operational, reinstall or reconnect and test each expansion card and external device one at a time.
3. When using the symptom/cure charts, always try the solutions one at a time, in sequence, until you fix the problem. If the problem remains, reinstall the original module before trying the next solution.
4. The hardware troubleshooting flowcharts verify each repair action by looping back to the start (Flowchart 1). If a repair does not fix the problem, reinstall the original module, return to the flowblock of origin, and perform the next repair action on the list.
5. When instructed to replace the logic board only, place the customer's SIMMs on the replacement logic board. There is never a need to move the ROM SIMM from one logic board to another. Certain logic boards, built early in production, use a ROM SIMM. Boards produced later have ROMs mounted directly on the logic board. Moving the ROM SIMM, will cause the board to be rejected by Apple.
6. Always verify that the original problem has been fixed. To verify that the original problem is fixed, duplicate the conditions under which it appeared. To verify that there are no additional faults, run MacTest Pro.

Startup Problems – Flowcharts



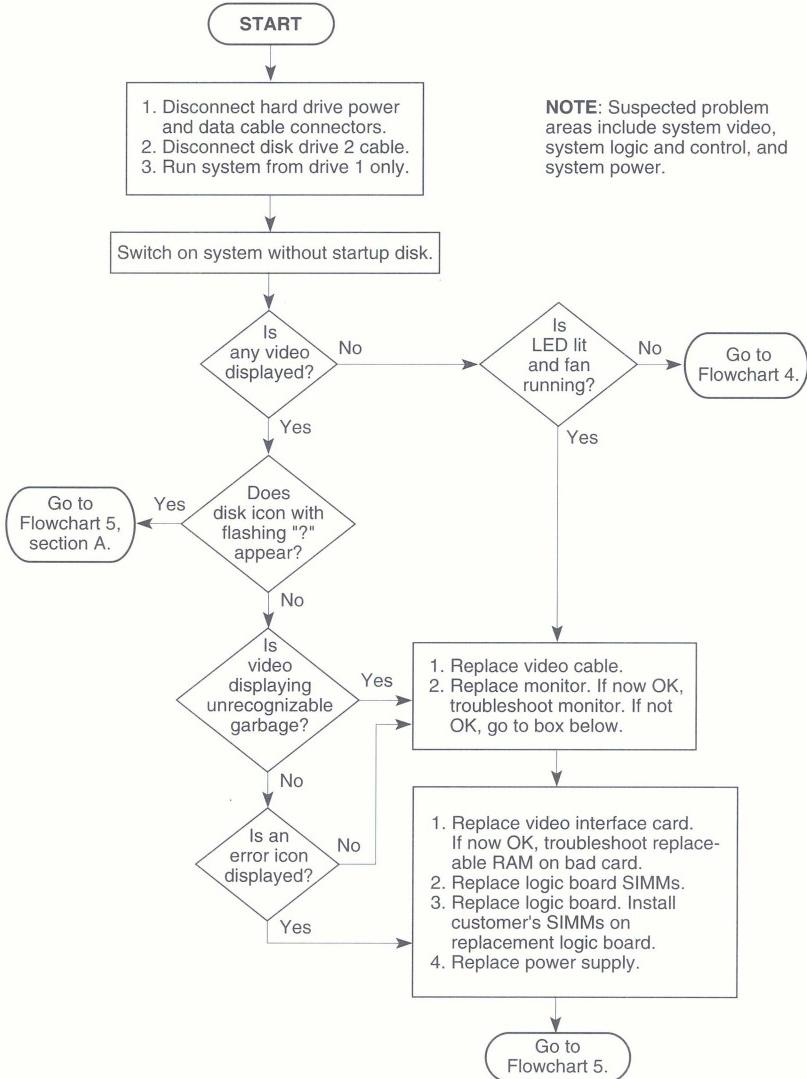
Flowchart 1 Startup Problems

NOTE: During a normal chord sequence, you'll hear a single, medium-pitched startup chord only.

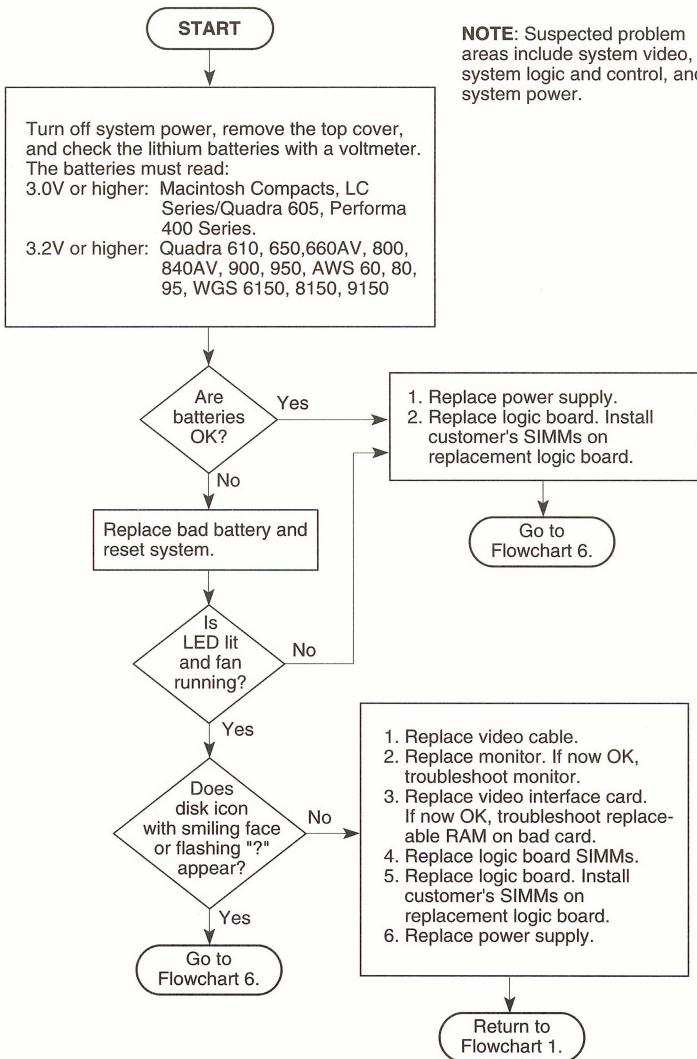


NOTE: If the first corrective action doesn't fix the problem, return the system to its original condition and perform the next action.

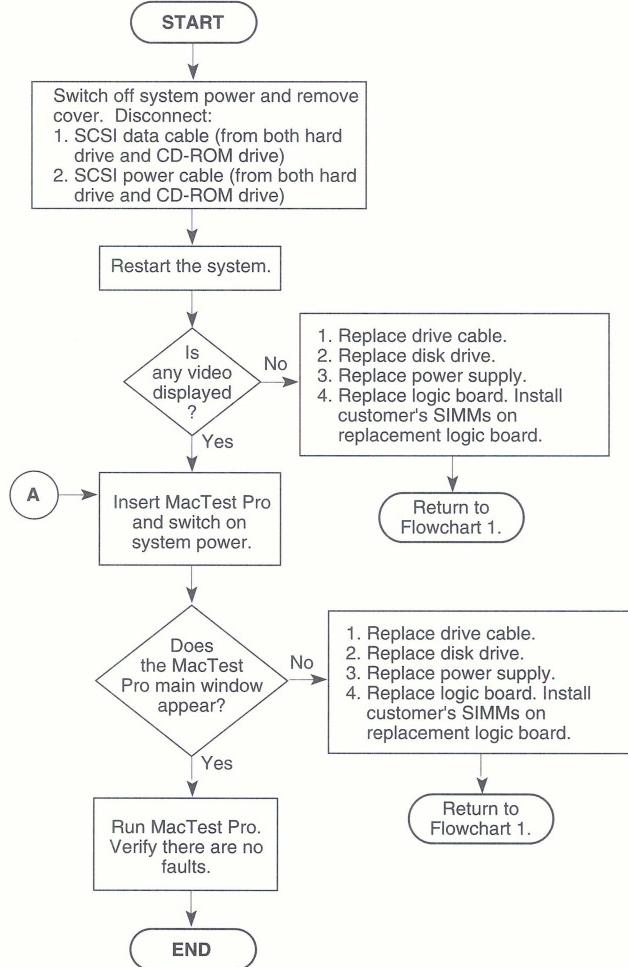
Flowchart 2 Startup and Error Chords

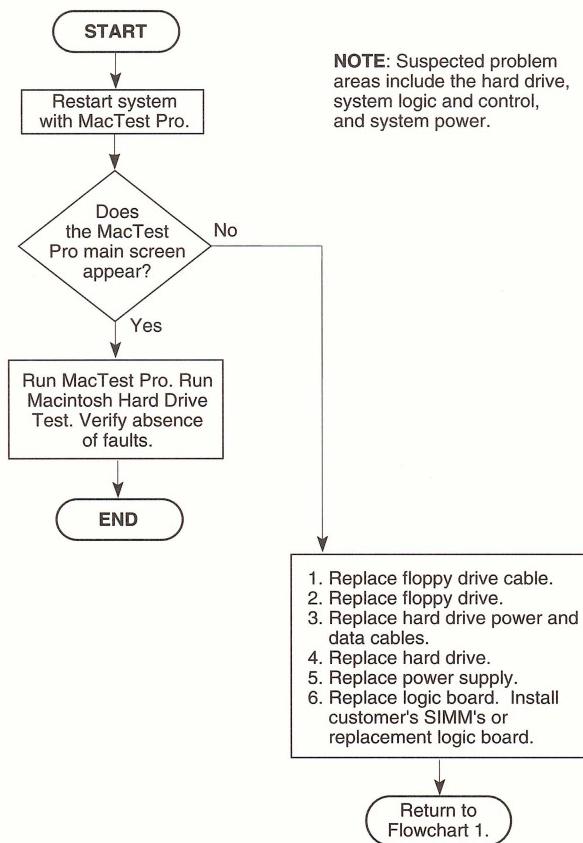


Flowchart 3 Startup Problems



Flowchart 4 Startup Problems





Flowchart 6 Startup Problems

MacTest Pro is a modular software program that you can use as a diagnostic test at the beginning of the troubleshooting process, to help identify the source of problems with Macintosh computers and peripherals. It can also be used as a confidence test after you have completed your repair steps, to verify that the problems identified earlier were successfully repaired.

The modular design of MacTest Pro allows you to customize the software for use in different testing and repair environments, such as on-site service and repair centers. MacTest Pro can also be customized for the types of hardware that you work with most frequently, such as Macintosh II's, PowerBooks, Apple Workgroup Servers, or Power Macintosh systems.

Additional Sources of Information

In addition to the overview presented here, there are several other sources of information about MacTest Pro. The *MacTest Pro User's Guide* and the *MacTest Pro Reference Guide* are distributed with the software program. The READ ME FIRST file is distributed on the MacTest Pro Applications and Modules disk, and contains the most up-to-date information on new or revised MacTest Pro software. Periodically, screen-readable versions of the MacTest Pro documentation are posted to AppleLink (path: Apple Service/Training icon; Service & Support bulletin board; Service & Support folder; Diagnostics folder). Occasionally, when it is necessary to release a new or revised test module to the field more quickly than the subscription mailing process will allow, the test module may be posted to AppleLink (same path as above) so that Service Providers can download it at their convenience. Announcements regarding update mailings are included in the Apple Service Notices (included with the *Service Source* CD and on AppleLink).

How to Obtain MacTest Pro

MacTest Pro software is available for purchase as part of the Macintosh Family Diagnostics Starter Kit (Service Part Number 077-8312). The Starter Kit also includes a one year subscription to the Macintosh Family Diagnostics Renewal Program (Service Part Number 011-7091). The subscription must be renewed yearly in order to continue receiving updates and revisions to diagnose and test new Macintosh products.

Suggestions for Using MacTest Pro

MacTest Pro is distributed on one non-bootable disk, called MacTest Pro Applications and Modules, and on several bootable disks. If the computer you are diagnosing cannot boot from its own hard drive, or if its system software is suspect, you may want to use the bootable disk configured for the particular Macintosh being tested.

In possible, you will want to boot the computer from its own hard drive, preferably with extensions off. You can create a MacTest Pro folder on the hard drive by dragging/copying the MacTest Pro Application and the suite of test modules you wish to run from the MacTest Pro Applications and Modules disk to the hard drive. Now you can launch MacTest Pro from the hard drive.

Placing the application and test modules on the customer's hard drive has several advantages. First, it allows you to customize the test suite you wish to load, which helps avoid the "out of memory" condition that can occur if you try to load more test modules than the customer's system can handle. Second, it avoids having to run the computer without the Finder, which can be very inconvenient if you need to turn AppleTalk on or off while running the tests. Launching MacTest Pro from the hard drive also allows you to save and print test reports more conveniently. Finally, the tests usually run faster from the hard drive than from a floppy.

MacTest Pro Bootable Disk Configurations

Each of the MacTest Pro bootable disks is configured to boot on a different "family" of Macintosh computers, as described below. Each disk contains the MacTest Pro application, several critical test modules, the required system enablers (if any), and a specially configured minimum System file. In order to fit on the bootable disk with the MacTest Pro application and test modules, this minimum System file does not include the Finder. (Note that this information is subject to change as new Macintosh systems are introduced.)

Macintosh CPU Tests, Volume 1A

This bootable startup disk tests the Macintosh SE/30, IIcx, IIci, IIsi, II, IIx, and IIfx computers.

Macintosh CPU Tests, Volume 1B

This bootable startup disk tests the Macintosh Classic II, Color Classic, LC, LC II, LC III, LC 520, IIvx, IIvi, Performa 200, 250, 275, 400, 405, 410, 430 450, 460, 466, 467, 520, 600, 600CD and Macintosh TV computers.

This disk also provides the following system enablers (used with System 7.1 or later software):

- Enabler 001 – for Macintosh IIvx, IIvi, Performa 600, and Performa 600CD
- Enabler 003 – for Macintosh LC III
- Enabler 308 – for Macintosh Performa 450, 460, 466, and 467
- Enabler 332 – for Macintosh Performa 250, 275, and 550
- Enabler 401 – for Macintosh Color Classic and Performa 250
- Enabler 403 – for Macintosh LC 520 and Performa 520
- Enabler 404 – for Apple Macintosh TV

Macintosh CPU Tests, Volume 2

This bootable startup disk tests the Macintosh LC 475, Performa 475 and 476, Macintosh Centris 610 and 650, Macintosh Quadra 605, 610, 650, 700, 800, 900, and 950 computers.

This disk also provides the following system enablers (used with System 7.1 or later software):

- Enabler 040 – for Macintosh Quadra 610, 650, 800 and Centris 610 and 650
- Enabler 065 – for Macintosh LC 475, Performa 475 and 476, and Quadra 605

Macintosh CPU Tests, Volume 3

This bootable startup disk tests the Macintosh Centris 660AV and Quadra 660AV and 840AV computers.

This disk also provides System Enabler 088 for using System 7.1 or later software on Macintosh Centris 660AV and Quadra 660AV and 840AV computers.

PowerBook Tests, Volume 1

This bootable startup disk tests the Macintosh PowerBook 100, 140, 145, 145B, 160, 165, 165c, 170, 180, and 180c computers.

This disk also provides System Enabler 131 for using System 7.1 or later software on PowerBook 160, 165, 165c, 180, and 180c computers.

PowerBook Duo Tests, Volume 1

This bootable startup disk tests the Macintosh PowerBook Duo 210, 230, 250, and 270c computers, and the Macintosh Duo Dock I and Duo Dock II computers.

This disk also provides the PowerBook Duo Enabler for using System 7.1 or later software on PowerBook Duo 210, 230, 250, and 270c computers.

Power Macintosh CPU Tests, Volume 1

This bootable startup disk tests the Power Macintosh computers.

This disk also provides the Minimal PowerPC Enabler for using System 7.1.2 or later software on Power Macintosh computers.

Power Macintosh Upgrade Card Tests

This bootable startup disk tests the Power Macintosh Upgrade Cards.

This disk also provides the following system enablers (used with System 7.1.2 or later software):

- Minimal PowerPC Card Enabler – for Power Macintosh Upgrade Cards
- Enabler 040 – for Macintosh Quadra 610, 650, 800 and Centris 610 and 650 computers.

In addition to the computers listed above, this disk is also designed to start up on Macintosh Quadra 700, 900, and 950 computers in which a Power Macintosh Upgrade Card is installed.

Apple Personal Diagnostics

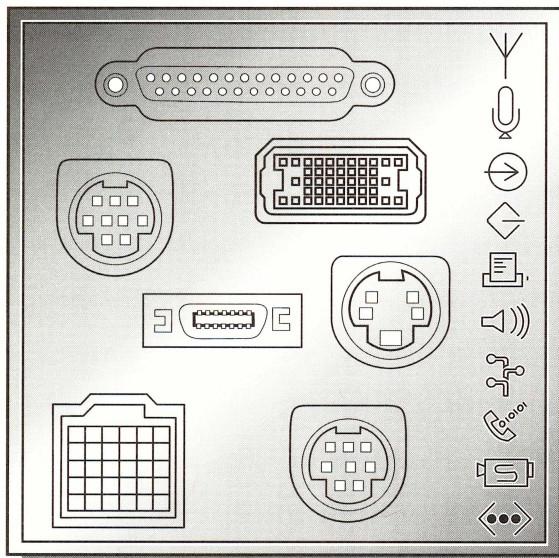
Apple Personal Diagnostics (APD) is designed to reduce system downtime, minimize support calls, offer troubleshooting tips, and help users identify the source of problems. The software combines system profiling, disk file structure repair, benchmark testing, hardware testing, and system software checking in one easy-to-use package giving users a wealth of information about their computers with a click of a mouse. APD will enable users to better isolate the cause of problems with their hardware and system software, and in many cases allow them to repair damaged disk file structures.

Note

APD is not intended for use as a service tool by Apple Authorized Service Providers. Apple Service continues to recommend MacTest Pro as the primary diagnostic and repair verification tool for AASPs. APD was designed to empower end users to identify irregularities that may affect system performance. APD, in combination with its supporting documentation, provides the means for a customer to become more effective at troubleshooting their Macintosh system.

There are some important differences between APD and MacTest Pro that service professionals should understand. MacTest Pro was designed solely for use by Apple Authorized Service Technicians. It is a more sophisticated diagnostic product than APD and includes advanced test options that are pertinent to a service/support professional. Regular releases of MacTest Pro are sent to authorized Service Technicians via an on-going subscription program each time new Apple CPUs are released. In addition, MacTest Pro tests are more in-depth and perform detailed verifications of the subcomponents contained in each computer Apple manufactures.

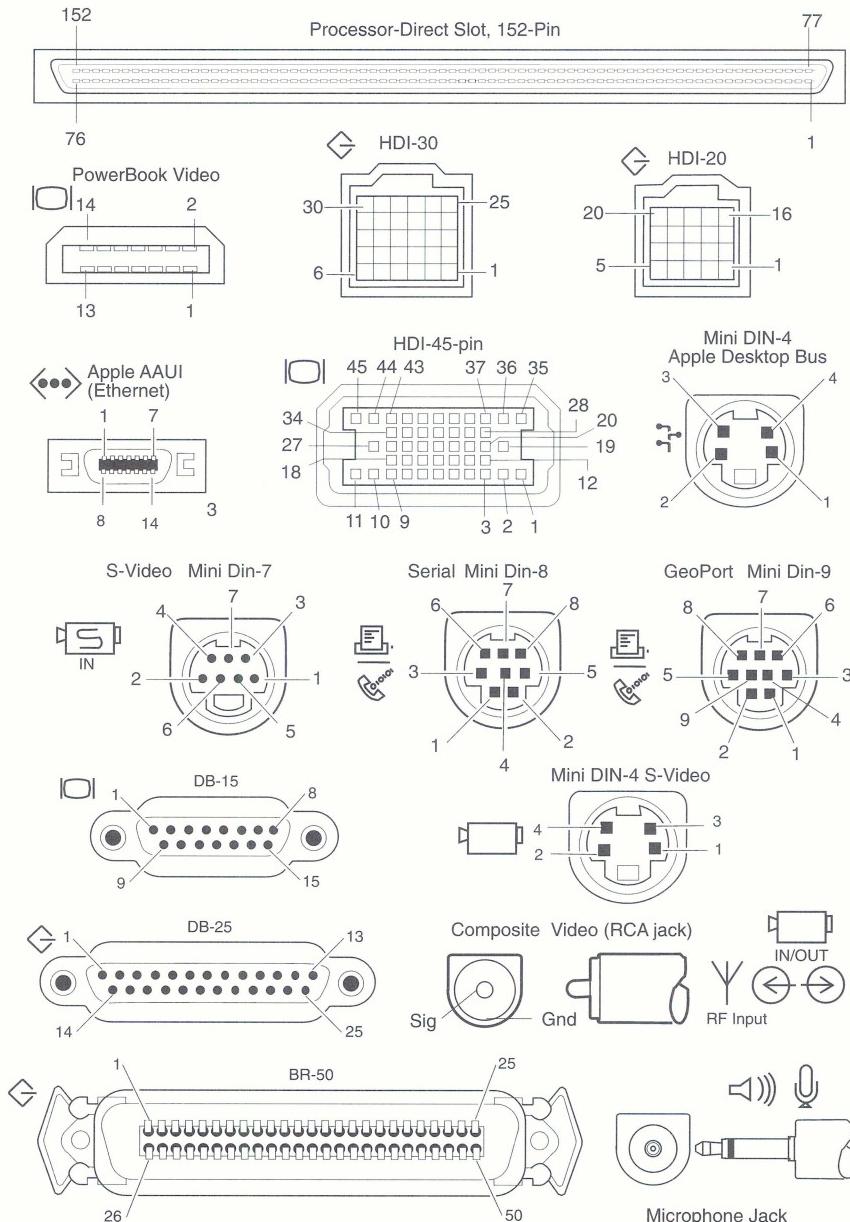
Ports and Pinouts



Cable Connectors	66
Pinouts	67
Computer Port Locations	79

Cable Connectors

The pin numbers shown below are for the connectors attached to the ends of the Macintosh peripheral cables, as viewed from the front of the connector.



Pinouts

GeoPort – Mini DIN-9

The back panel of all Power Macintosh models contain two I/O ports for serial telecommunication data. Both sockets accept 9-pin plugs allowing either port to be independently programmed for asynchronous or synchronous communication formats up to 9600 bps. This includes AppleTalk and the full range of Apple GeoPort protocols.

Pin	Name	Function
1	SCLK (out)	Reset pod or get pod attention
2	Sync (in)/SCLK (in)	Serial clock from pod (up to 920 Kbit/sec.)
3	TxD-	Transmit -
4	Gnd/shield	Ground
5	RxD-	Receive -
6	TxD+	Transmit +
7	Wake up/TxHS	Wake up CPU or do DMA handshake
8	RxD+	Receive +
9	+5 V	Power to pod (350 mA maximum)

Apple Desktop Bus Connector

Connector type: Mini DIN-4 male. The total length of all cables should not exceed 16 feet (5 meters).

Pin	Signal Name	Signal Description
1	Data	Bidirectional data bus
2*	Power On/	Signal momentarily grounded to pin 4 to begin power-up sequence in CPU
3	Power	+5 volts
4	Ground	Signal ground

* On the Macintosh II family, Quadra 700 and 900, and PowerBook series only. Pin 2 is unused on all other models.

Modem and Printer Ports

Connector type: Mini-DIN 8

Pin	Signal Name	Signal Description
1	HSKo	Handshake out
2	HSKi	Handshake in/external clock
3	TxD-	Transmit data -
4	GND	Signal ground
5	RxD-	Receive data -
6	TxD+	Transmit data +
7	NC	General purpose input*
8	RxD+	Receive data +

RCA Jack Pinout

Pin	Input Connector	Output Connector
1	AGND	AGND
2	AGND	AGND
3	Video Y (luminance)	Video Y (luminance)
4	Video C (chroma)	Video C (chroma)
5	I^2C clock (I-squared) ¹	Composite Video
6	+12 V at 250 mA maximum ²	No connection
7	I^2C data ¹	No connection

1 Phillips serial bus

2 Fused at 1.1 A

HDI-45

The Power Macintosh computers provide connection to AudioVision monitors (and other monitors when used with an adapter cable) by means of an AudioVision HDI-45 monitor socket on their back panel.

Pin	Description	Pin	Description
1	Analog audio ground	24	Reserved
2	Audio input shield	25	Reserved
3	Left channel audio input	26	Red ground (shield)
4	Right channel audio input	27	Red video output (75 Ω)
5	Left channel audio output	28	I ² C data signal* (I-squared)
6	Right channel audio output	29	I ² C clock signal* (I-squared)
7	Reserved	30	Reserved
8	Monitor ID sense line 1	31	Monitor ID
9	Monitor ID sense line 2	32	Monitor ID
10	Green ground (shield)	33	Vertical sync signal
11	Green video output (75 Ω)	34	Composite sync signal
12	Video input power ground	35	ADB power +5 V
13	Power for camera +5 V	36	ADB ground
14	Reserved	37	ADB data
15	Reserved	38	Keyboard switch
16	Reserved	39	Reserved
17	Reserved	40	Reserved
18	Monitor ID sense line 3	41	Monitor ID
19	S-video input shield	42	Horizontal sync signal
20	S-video input luminance (Y)	43	Video sync ground
21	S-video input chroma (C)	44	Blue ground (shield)
22	Reserved	45	Blue video output (75 Ω)
23	Reserved		

* Phillips serial bus interface

Ethernet-AAUI Connector Pinouts

The AAUI (Apple Attachment Unit Interface) connector is a 14-position, 0.050-inch-spaced ribbon contact connector. AAUI signals have the same description, function, and electrical requirements as the AUI signals of the same name, as detailed in the IEEE Standard 802.3-1990 CSMA/CD, section 7.

Pin	Signal Name	Signal Description
1	FN Pwr	Power (+12V @ 2.1W or +5V @ 1.9W)
2	DI-A	Data in circuit A
3	DI-B	Data in circuit B
4	VCC	Voltage Common
5	CI-A	Control In circuit A
6	CI-B	Control In circuit B
7	+5V	+5 volts (from host)
8	+5V	Secondary +5 volts (from host)
9	DO-A	Data Out circuit A
10	DO-B	Data Out circuit B
11	VCC	Secondary Voltage Common
12	NC	Reserved
13	NC	Reserved
14	FN Pwr	Secondary +12V @ 2.1W or +5V @ 1.9W
Shell	Protective Gnd	Protective Ground

Audio Output Connector – Stereo

Connector type: Stereo miniature phone plug (3.6 mm). The internal speaker is disabled when this connector is in use.

Pin	Signal Name	Signal Description
(Sleeve)	GND	Signal ground
(Tip)	Left	1-volt*, peak-to-peak audio signal with an impedance of 47 ohms, left channel
(Ring)	Right	1-volt*, peak-to-peak audio signal with an impedance of 47 ohms, right channel

- * The PowerBook series produce a 0.75-volt, peak-to-peak signal.

Audio Output Connector – Monoaural

Connector type: Monoaural miniature phone plug (3.6 mm). The internal speaker is disabled when this connector is in use.

Pin	Signal Name	Signal Description
(Sleeve)	GND	Signal ground
(Tip)	AUDIO	.5-volt, peak-to-peak audio signal

Microphone Input Connector

Connector type: Stereo miniature phone plug (3.6 mm).

- ▲Caution** Do not connect any device other than the Macintosh microphone into the microphone input connector. The connector provides +8 volts for the microphone. Connecting incompatible devices could damage the device or computer.

Pin	Signal Name	Signal Description
(Sleeve)	GND	Signal ground
(Tip)	+8V	+8 volts for powering electret microphone
(Ring)	Right	Audio input with a maximum amplitude of 20 mV at 600 ohms impedance

HDI-30 and BR-50 SCSI Disk Adapter Cable

These connectors are found on the SCSI Disk Adapter cable. The pin numbers that are not mentioned are reserved.

HDI-30	BR-50	Signal Name	Signal Description
2	26	/DB0	SCSI data bit 0
1, 3	19	GND	Ground, Pin 1 enables SCSI disk mode
4	27	/DB1	SCSI data bit 1
5	38	TERMPWR	Termination power (not supplied by PowerBook 100)
6	28	/DB2	SCSI data bit 2
7	29	/DB3	SCSI data bit 3
8	1, 4	GND	Ground
9	44	/ACK	SCSI acknowledge
10	5	GND	Ground
11	30	/DB4	SCSI data bit 4
12	2, 3, 8	GND	Ground
13	11, 9, 6	GND	Ground
14	31	/DB5	SCSI data bit 5
15	24	GND	Ground
16	32	/DB6	SCSI data bit 6
17	7	GND	Ground
18	33	/DB7	SCSI data bit 7
19	34	/DBP	SCSI data bit parity
20	23, 16, 20	GND	Ground
21	49	/REQ	SCSI request
22	21, 22	GND	Ground
23	43	/BSY	SCSI busy
24	25	GND	Ground
25	41	/ATN	SCSI attention
26	48	/C/D	SCSI control/data
27	45	/RST	SCSI bus reset
28	46	/MSG	SCSI message
29	47	/SEL	SCSI select
30	50	/I/O	SCSI input/output

External Video Connector

Connector type: 14-pin, high-density female. All Apple-manufactured Macintosh monitors except the 21-inch Color Display and Two-Page Monochrome Monitor are supported.

Pin	Signal Name	Signal Description
1	RED.VID	Red video
2	RED.GND	Red video ground
3	MON.ID1	Monitor ID, bit 1
4	VSYNC/	Vertical sync
5	CSYNC/	Composite sync
6	C&VSYNC.GND	Composite & vertical sync ground
7	GRN.GND	Green video ground
8	GRN.VID	Green video
9	MON.ID2	Monitor ID, bit 2
10	H SYNC.GND	Horizontal sync ground
11	MON.ID3	Monitor ID, bit 3
12	H SYNC/	Horizontal sync
13	BLU.VID	Blue video
14	BLU GND	Blue video ground
Shell	CHASSIS GND	Chassis ground

SCSI Connector – DB-25

Total length of all SCSI cables should not exceed 20 feet (6 meters).

▲Caution This interface uses the same type of connector as a standard RS-232 serial interface but is electrically very different. DO NOT connect RS-232 devices or cables to this port. Doing so can damage the device and the computer.

Pin	Signal Name	Signal Description
1	REQ/	Request
2	MSG/	Message
3	I/O/	Input/output
4	RST/	Reset
5	ACK/	Acknowledge
6	BUSY/	Busy
7	GROUND	Signal ground
8	Data0/	Data bit 0
9	GND	Signal ground
10	Data3/	Data bit 3
11	Data5/	Data bit 5
12	Data6/	Data bit 6
13	Data7/	Data bit 7
14	GND	Signal ground
15	C/D/	Control/data
16	GND	Signal ground
17	ATN/	Attention
18	GND	Signal ground
19	SEL/	Select
20	PARITY/	Data parity
21	Data1/	Data bit 1
22	Data2/	Data bit 2
23	Data4/	Data bit 4
24	GND	Signal ground
25	TERMPWR	+5 volts terminator power

SCSI Connector – HDI-30

This connector is present on the Macintosh PowerBook series (except the Duo 210/230).

Pin	Signal Name	Description
1	SCSI-Mode/	SCSI disk mode enable signal
2	Data0/	Data bit 0
3	GND	Signal ground
4	Data1/	Data bit 1
5	Termpwr	+5 volts termination power
6	Data2/	Data bit 2
7	Data3/	Data bit 3
8	GND	Signal ground
9	ACK/	Acknowledge
10	GND	Signal ground
11	Data4/	Data bit 4
12	GND	Signal ground
13	GND	Signal ground
14	Data5/	Data bit 5
15	GND	Signal ground
16	Data6/	Data bit 6
17	GND	Signal ground
18	Data7/	Data bit 7
19	PARITY/	Data parity
20	GND	Signal ground
21	REQ/	Request
22	GND	Signal ground
23	BUSY/	Busy
24	GND	Signal ground
25	ATN/	Attention
26	C/D/	Control/data
27	RST/	Reset
28	MSG/	Message
29	SEL/	Select
30	I/O/	Input/output

External Floppy Drive Connector – HDI-20

This connector is present on the Macintosh Duo MiniDock and PowerBook Duo Floppy adapter. An HDI-20 1.4 MB drive can be connected to this port.

Pin	Signal Name	Description
1	GND	Signal ground
2	GND	Signal ground
3	GND	Signal ground
4	GND	Signal ground
5	NC	No connection
6	+5V	+5 volts DC
7	+5V	+5 volts DC
8	+5V	+5 volts DC
9	+5V	+5 volts DC
10	NC	No connection
11	PH0	Phase 0
12	PH1	Phase 1
13	PH2	Phase 2
14	PH3	Phase 3
15	WREQ/	Write request
16	HDSEL	Head select
17	ENBL2/	External drive select
18	RD	Read data
19	WR	Write data
20	NC	No connection

External Monitor Connector

Connector type: DB-15.

Pin	Description	Pin	Description
1	Red ground	9	Blue video signal
2	Red video signal	10	Monitor sense 2
3	Composite synchronization	11	Synchronization ground
4	Monitor sense 0	12	Vertical synchronization
5	Green video signal	13	Blue ground
6	Green ground	14	Horizontal synchronization
7	Monitor sense 1	15	Horizontal synchronization ground
8	No connection		

S-Video Input

The Power Macintosh AV card also contains two identical connectors for S-video input and output, with adapter cables for composite video devices that have RCA connectors, like television equipment.

4

Pin	Input Connector	Output connector
1	AGND	AGND
2	AGND	AGND
3	Video Y (luminance)	Video Y (luminance)
4	Video C (chroma)	Video C (chroma)
5	I ² C clock (I-squared) ¹	Composite video
6	+12 V at 250 mA maximum ²	No connection
7	I ² C data ¹	No connection

1 Phillips serial bus

2 Fused at 1.1 A

Coax/Twinax Interface Card – Coax Connector

Connector type: BNC male

Pin	Signal Name	Signal Description
(Tip)	CX+	Transmit/receive data
(Sleeve)	CX-	Signal ground

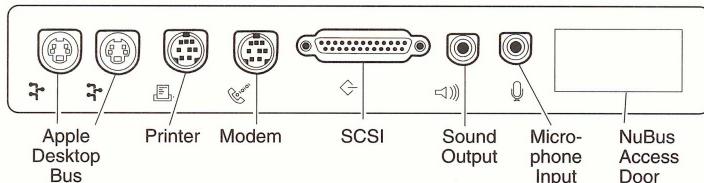
Coax/Twinax Interface Card – Twinax Connector

Connector type: DE-9 female

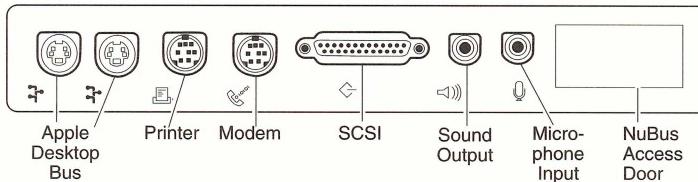
Pin	Signal Description	Pin	Signal Description
1	No connection	9	No connection
2	No connection	10	No connection
3	No connection	11	No connection
4	No connection	12	No connection
5	No connection	13	No connection
6	No connection	14	"B" twinax signal
7	"A" twinax signal	15	No connection
8	No connection		

Computer Port Locations

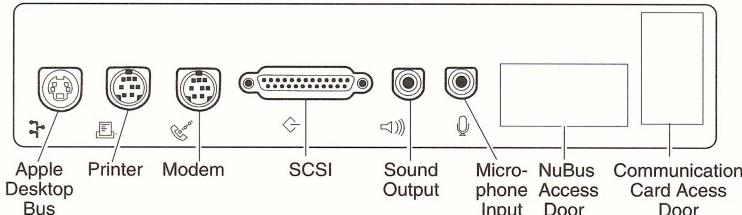
Macintosh Color Classic



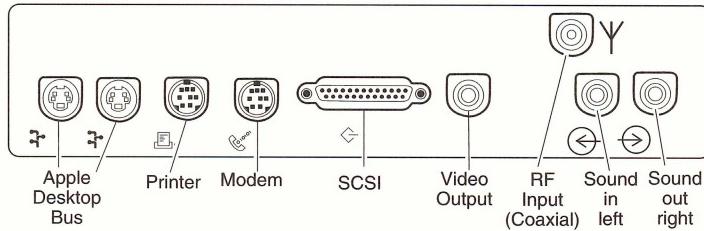
Macintosh LC 520, 550; Performa 550, 560



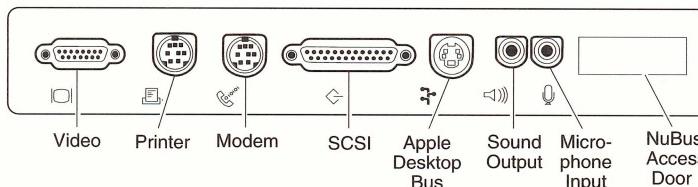
Macintosh LC 575; Performa 575



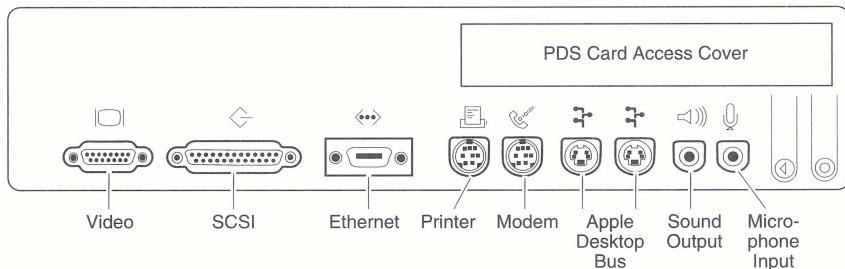
Macintosh TV



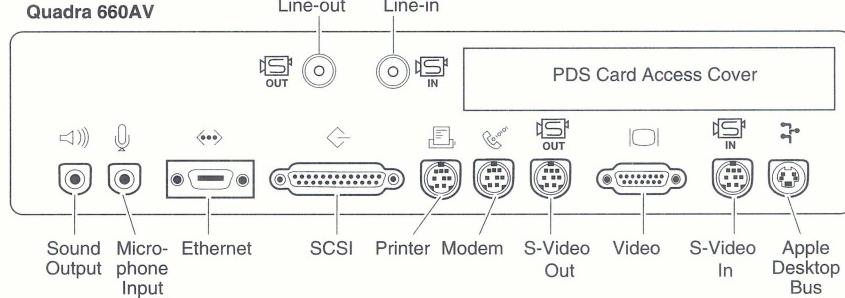
Macintosh LC III, LC 475; Performa 450, 460, 466, 467, 475, 476; Quadra 605



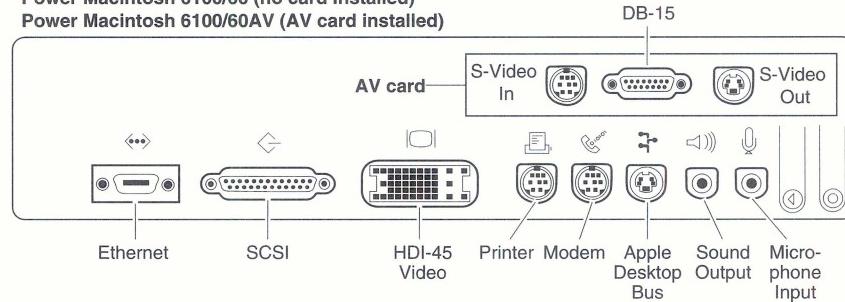
Macintosh Quadra 610; WS 60



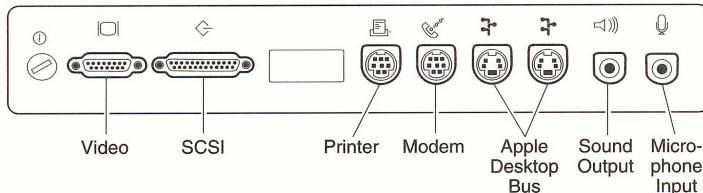
Quadra 660AV



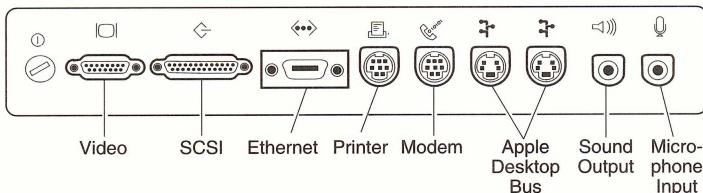
Power Macintosh 6100/60 (no card installed)
Power Macintosh 6100/60AV (AV card installed)



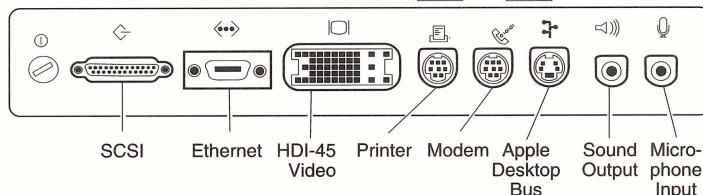
Quadra 650, Performa 600



Quadra 650



**Power Macintosh 7100/66
Power Macintosh 7100/66AV**



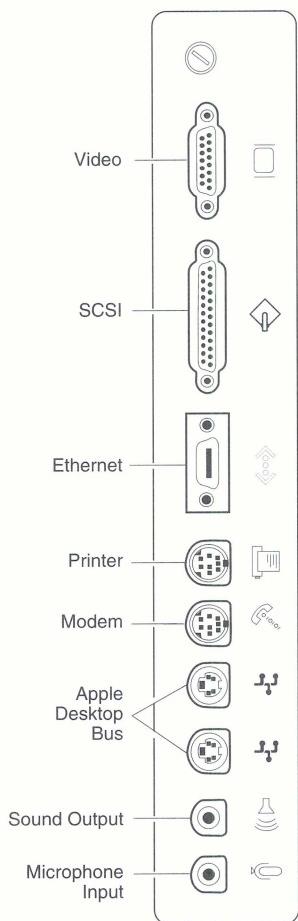
Note 1

The figure shows a Power Macintosh 7100/66 with a 2 MB video card installed (DB-15 connector).

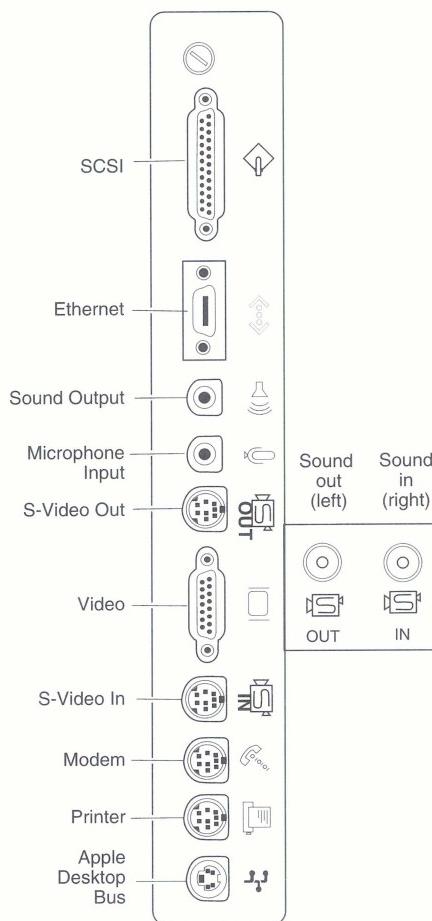
Note 2

The figure shows a Power Macintosh 7100/66AV video card installed (DB-15 connector) and S-Video input and S-Video output ports.

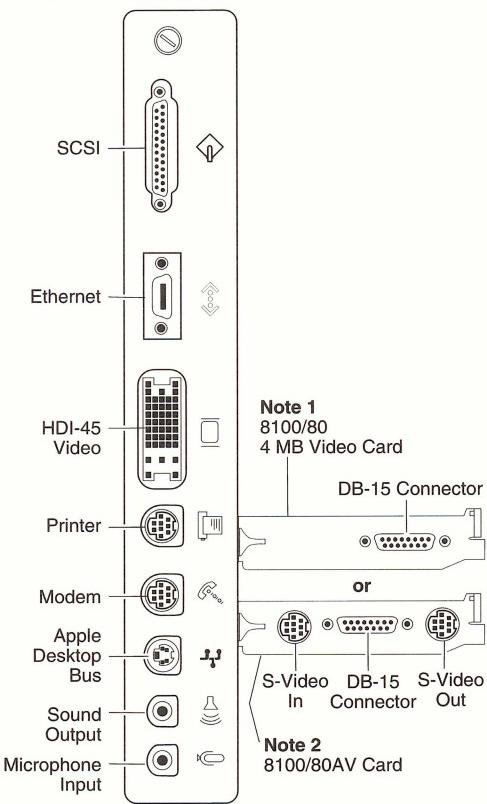
Macintosh Quadra 800



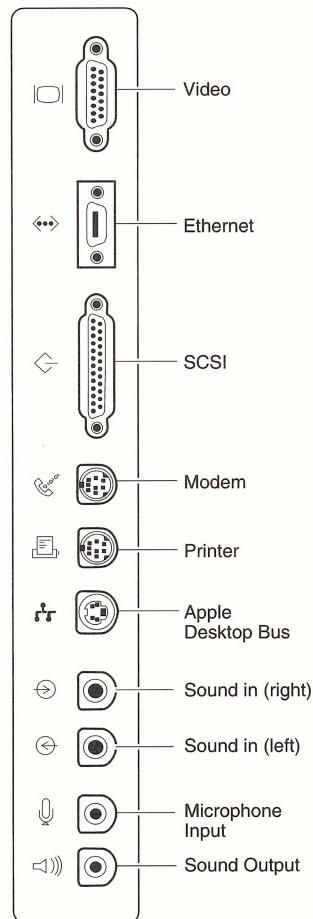
Macintosh Quadra 840AV



**Power Macintosh 8100/80
Power Macintosh 8100/80AV
Workgroup Server 8150**



**Workgroup Server 95
Workgroup Server 9150**



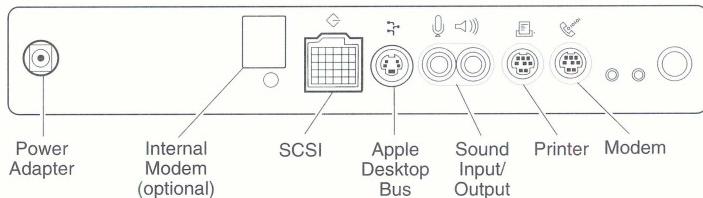
Note 1

The figure shows a Power Macintosh 8100/80 with a 4 MB video card installed (DB-15 connector).

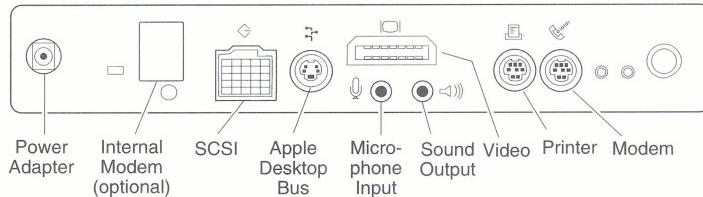
Note 2

The figure shows a Power Macintosh 8100/80AV with a video card installed (DB-15 connector) and S-Video input and S-Video output ports.

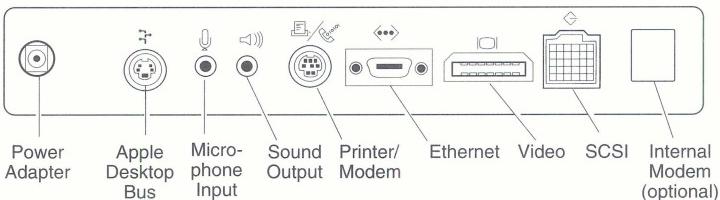
PowerBook 145, 145B, 170



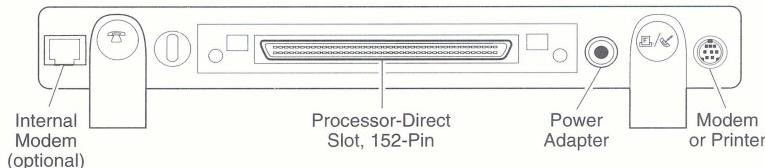
PowerBook 165, 165c, 180, 180c



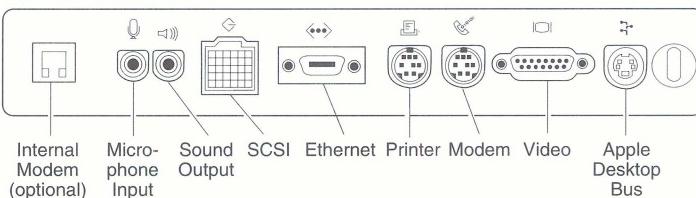
PowerBook 520, 520c, 540, 540c



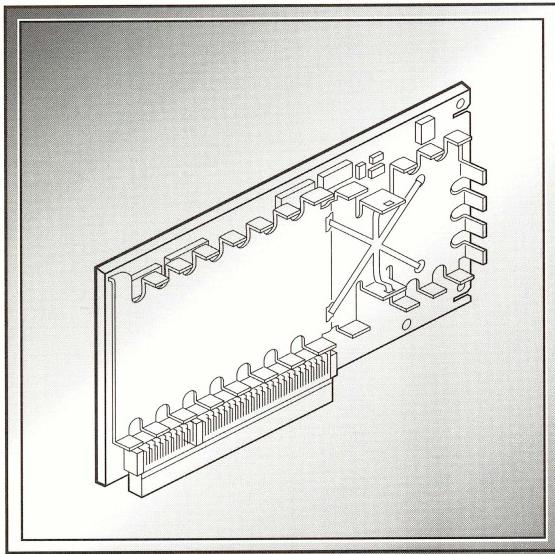
PowerBook Duo 250, 270c, 280, 280c



Macintosh Duo Dock II



Power Macintosh Upgrade Card



5

Specifications	86
Macintosh PDS Slot Locations	87
Symptom/Cure Chart	88

Specifications – Power Macintosh Upgrade Card

Processor	PowerPC 601 microprocessor; requires system software version 7.1.2 or later
Memory	DRAM: System you are upgrading with the Power Macintosh Upgrade Card must have a minimum of 8 MB of RAM ROM: 4 MB SRAM: 1 MB of cache

The Power Macintosh Upgrade Card (Figure 1) is compatible with any 68040 Macintosh computer that has a processor-direct (PDS) slot (Figure 2). This card adds the benefits of Power Macintosh technology to your Macintosh and it doubles the 68040 processor speed up to a maximum of 66 MHz. This card is user installable. Refer to the “Power Macintosh System Overview” in Chapter 2, General Information, for additional information.

- Note** The Power Macintosh Upgrade Card does not support AV functions.

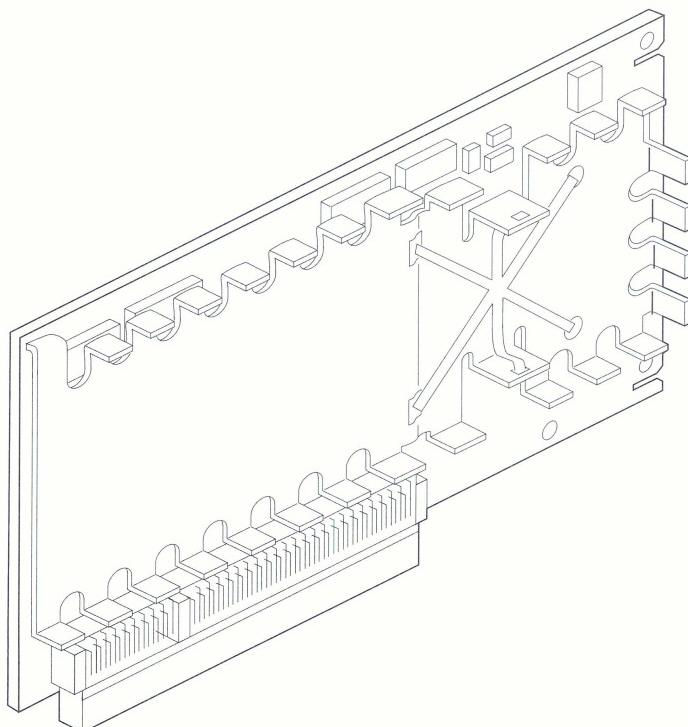
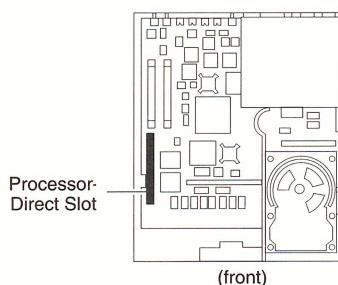
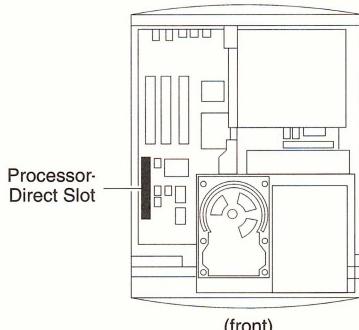


Figure 1 Power Macintosh Upgrade Card

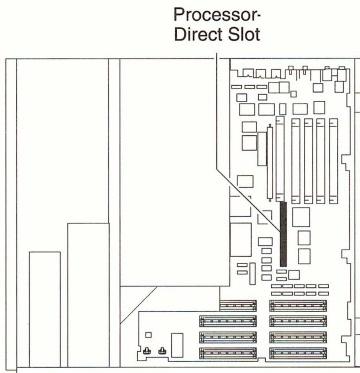
Macintosh PDS Slot Locations



Macintosh Quadra 700

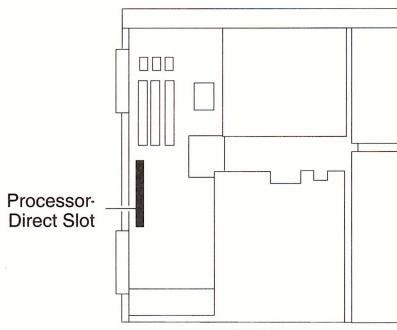


Macintosh Quadra 650

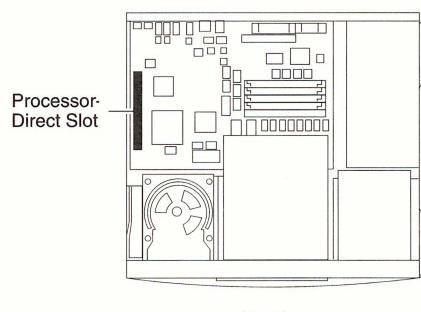


Macintosh Quadra 900/950

5



Macintosh Quadra 800



Macintosh Quadra 610

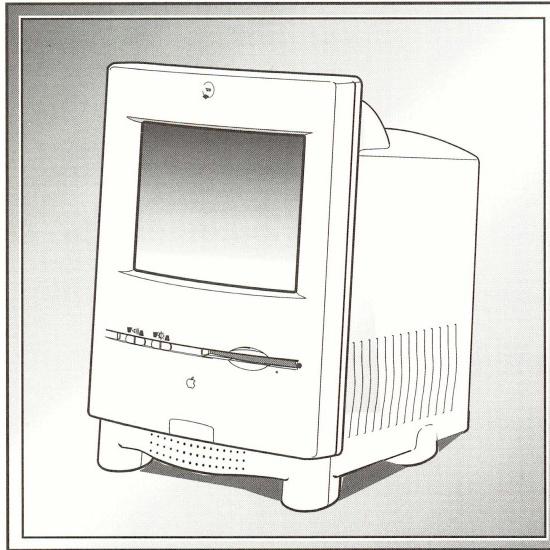
Note: The Quadra 610 requires an adapter to install the Power Macintosh Upgrade Card.

Figure 2 Macintosh PDS Slot Locations

Symptom/Cure Chart – Power Macintosh Upgrade Card

General Problems	Solutions
Computer won't start	<ol style="list-style-type: none">1. Reseat Power Macintosh Card.2. Verify that computer has at least 8 MB of RAM.3. Replace Power Macintosh Card.
Can't open program, or program quits unexpectedly	<ol style="list-style-type: none">1. Quit other program, or restart computer.2. Allocate more memory for the program via the program's Get Info window.3. Turn on virtual memory via the Memory control panel.4. Turn off Power Macintosh Card via the control panel.5. Reinstall system software.6. Install additional RAM.
Application doesn't work properly; system error messages	<ol style="list-style-type: none">1. If using an older application, turn off Modem Memory Manager via the Memory control panel and restart the computer.2. Before running the application, turn off the Power Macintosh Card via the control panel. Choose Shut Down from Special menu. Wait 10 seconds and switch on the computer.
Application runs slower than before card was installed	<ol style="list-style-type: none">1. If application was not designed for the Power Macintosh, then before running the application, turn off the Power Macintosh Card via the control panel. Choose Shut Down from the Special menu. Wait 10 seconds and switch on the computer.
System runs out of memory when running Power Macintosh applications	<ol style="list-style-type: none">1. Turn on virtual memory via the Memory control panel. (Hint: Set the virtual memory size to the size of the available built-in memory plus 1 MB.)2. Install additional RAM.
Card is turned on in control panel, but computer starts up with card turned off	<ol style="list-style-type: none">1. After turning on the card in the control panel, make sure you choose Shut Down (not Restart) to turn off computer completely before restarting it.
Mouse tracking on screen is erratic	<ol style="list-style-type: none">1. Turn off virtual memory via the Memory control panel.2. Install additional RAM.
Computer behaves strangely or has problems starting up	<ol style="list-style-type: none">1. Clear parameter RAM. Be sure to turn back on Power Macintosh Card and reset date, time, monitors, and file sharing.

Macintosh Color Classic



Illustrated Parts List	90
Logic Board Diagram	92
Specifications	93
Symptom/Cure Chart	94
Upgrades	99
Video Adjustments	100

Illustrated Parts List – Macintosh Color Classic

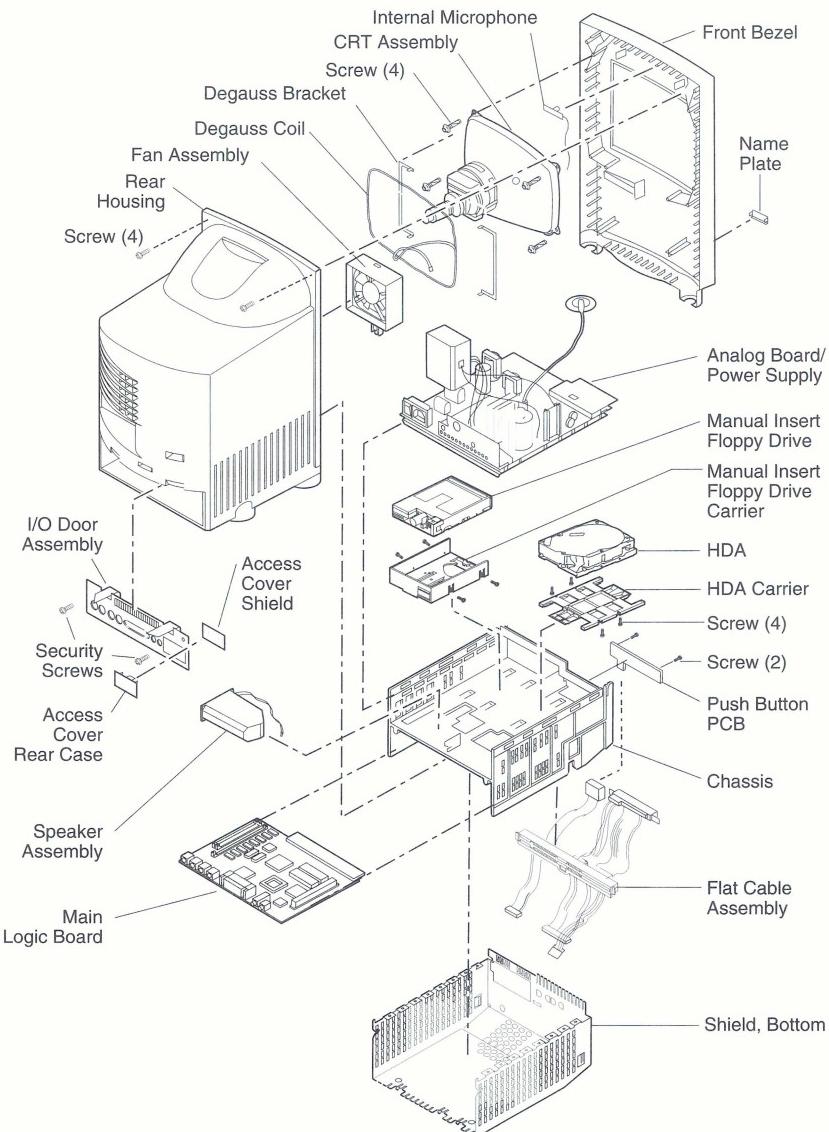


Figure 1 Macintosh Color Classic Exploded View

Analog Board/ Power Supply.....	661-0732
Chassis Assembly	
Cable, Flat Assembly	922-1804
Chassis.....	922-1809
PCB, Push Button	922-1800
Shield, Bottom.....	922-1810
CRT Assembly	
9" RGB CRT Assembly, Australian	661-0024
9" RGB CRT Assembly, Domestic	661-0004
9" RGB CRT Assembly, European.....	661-0022
Degauss, Bracket (Pkg. of 10)	922-1818
Degauss Coil	922-1816
Floppy Drive	
Apple SuperDrive, 1.4 MB Drive Mechanism.....	661-0474
Apple SuperDrive, Manual Insert Floppy Drive	661-0121
Carrier, Floppy, Manual Insert	922-0445
Carrier, SuperDrive	922-1807
Screw, Plastic Case/ Floppy Carrier.....	416-1305
Shield, SuperDrive	922-1808
Front Bezel	
Front Bezel.....	922-1811
Front Bezel, Manual Insert Floppy	922-0446
Internal Microphone.....	922-1802
Name Plate (Pkg. of 10)	922-1813
Screw, Tap, 4-20x.375 (Pkg. of 10).....	922-1819
Hard Drive	
Carrier, Hard Drive, 3.5"	922-1806
HDA, 40 MB, 3.5" SCSI	661-0112
HDA, 40 MB, 3.5" SCSI.....	661-0773
HDA, 80 MB, 3.5" SCSI.....	661-0774
HDA, 80 MB, 3.5" SCSI.....	661-1649
HDA, 80 MB, 3.5" SCSI.....	661-0111
HDA, 160 MB, 1" High, 3.5" SCSI	661-1647
Screw, SEMS 6-32x313 Pn CRS	440-6105
Logic Board	
DRAM SIMM, 1 MB, 80 ns	661-0520
DRAM SIMM, 1 MB, 80 ns	661-0719
DRAM SIMM, 1 MB, 80 ns, 72 Pin.....	661-0734
DRAM SIMM, 2 MB, 80 ns	661-0643

DRAM SIMM, 4 MB, 80 ns, 72 Pin	661-0808
DRAM SIMM, 8 MB, 80 ns, 72 Pin	661-0809
Lithium Battery w/o Leads	742-0011
Logic Board	661-0733
VRAM SIMM, 256K 80 ns	661-0722
Rear Housing	
Access Cover, Rear Case	815-1154
Access Cover, Shield, Rear Case	805-0137
Fan Assembly	922-1803
I/O Door Assembly	922-1815
Rear Housing	922-1814
Rubber Feet	865-0051
Screw, Torx, K40 1.79x16. TP Flat (Pkg of 10)	922-0392
Speaker Assembly	922-1801
Miscellaneous	
Apple Keyboard II	661-0603
Mouse, Apple Desktop Bus II	661-0763

Logic Board Diagram

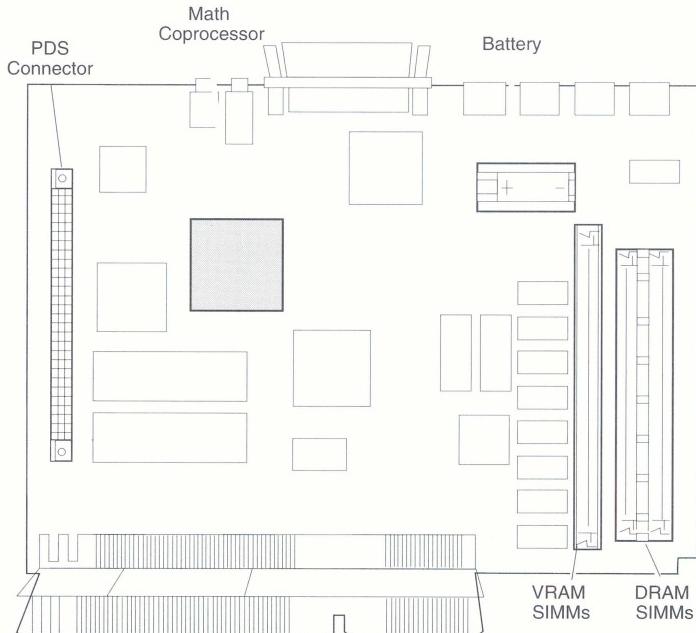


Figure 2 Color Classic Logic Board

Specifications – Macintosh Color Classic

Processor	CPU: Motorola 68030 microprocessor; 16 MHz; built-in paged memory management unit (PMMU); 256-byte instruction and data caches Coprocessor: Socket for optional Motorola 68882 floating-point coprocessor; 16 MHz Addressing: 16-bit data bus; 32-bit address bus; 16-bit internal registers
Memory	RAM: 4 MB of dynamic RAM on board; expandable to 10 MB (100 ns or faster SIMMs); dual SIMM expansion slot (two 30-pin connectors); includes RAM disk software ROM: 1 MB of main ROM on board; 2 MB maximum of main ROM PRAM: 256 bytes of clock/calendar/parameter memory; long-life lithium battery VRAM: 256K of VRAM on board; expandable to 512K of VRAM with 256K VRAM SIMM (100 ns or faster VRAM SIMM); 68-pin VRAM SIMM connector
Disk Storage	Floppy Drive: Internal 1.4 MB Apple SuperDrive, Apple SuperDrive Manual Insert Floppy Drive Hard Drive: 3.5-inch, internal 40, 80, 160 MB SCSI hard drive
I/O Interfaces	Serial: Two RS-232/RS-422 serial ports; mini DIN-8 connectors SCSI: One SCSI parallel port; DB-25 connector; connects up to six external SCSI devices Apple Desktop Bus: Two ADB ports; mini DIN-4 connector; maximum of three ADB devices recommended; maximum current draw 500 mA Sound: Sound-input, external microphone port 8-bit monoaural sound, sampled at 22 or 11 KHz; monophonic sound-output jack for external audio amplifier or headphones Processor-Direct Slot: Macintosh LC-compatible, 96-pin PDS expansion connector
I/O Devices	Keyboard: 80 key with numeric keypad; soft power-on switch Mouse: Apple Desktop Bus Mouse II Microphone: Built-in electret, omnidirectional microphone Speaker: Adjustable sound control on front of bezel
Sound and Video	Sound Generator: 8-bit digital analog conversion, using 22-KHz sampling rate VRAM: Standard 256K of VRAM on board displays up to 256 colors; enhanced 512K of VRAM displays up to 32,000 colors Video Display: 10-in. (diagonal) Trinitron CRT, 9-in. viewable screen; 512 by 384 pixels; 76 dpi
Electrical	Line Voltage: 90-240 VAC; universal power supply Frequency: 47-63 Hz, single phase Maximum Power: 100 W
Physical	Height: 14.5 in (37.0 cm) Width: 9.9 in. (25.2 cm) Depth: 12.6 in. (32.15 cm) Weight: 22.5-23.2 lb. (10.2-10.5 kg)

Symptom/Cure Chart – Macintosh Color Classic

Video Problems	Solutions
Screen is black, too dark, or too bright; audio and drive operate	<ol style="list-style-type: none">1. Adjust contrast button on front bezel.2. Adjust brightness. Use Brightness control panel.3. Check yoke cable connection.4. Perform video adjustments.5. Reseat analog board.6. Replace analog board.7. Replace CRT.
Screen is black: power-on light, fan, and drives function	<ol style="list-style-type: none">1. Reseat analog board.2. Replace analog board.3. Replace logic board.4. Replace CRT.
Screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none">1. Perform video adjustments.2. Reseat analog board.3. Replace analog board.4. Replace CRT.5. Replace logic board.
Single vertical or horizontal line displays	<ol style="list-style-type: none">1. Reseat analog board.2. Replace analog board.3. Replace logic board.4. Replace CRT.
Predominant color cannot be adjusted	<ol style="list-style-type: none">1. Perform video adjustments.2. Reseat analog board.3. Replace analog board.4. Replace CRT if red, green, or blue cannot be turned off using appropriate controls.
Picture breaks into diagonal lines, or picture rolls vertically or horizontally	<ol style="list-style-type: none">1. Reseat analog board.2. Replace analog board.
Out of convergence (color bleeds from text or lines)	<ol style="list-style-type: none">1. Perform convergence adjustment.2. Reseat analog board.3. Replace analog board.4. Replace CRT.
Black screen spots (burnt phosphors)	<ol style="list-style-type: none">1. Replace CRT.

-
- | | |
|---|---|
| Screen jitters or flashes | <ol style="list-style-type: none">1. Verify that adjacent computer equipment is properly grounded. Move electrical devices away from monitor. Temporarily shut off all fluorescent lights in area.2. Check that all ground cables are secure.3. Reseat analog board.4. Replace analog board. |
| Out of focus | <ol style="list-style-type: none">1. Perform focus adjustment.2. Reseat analog board.3. Replace analog board.4. Replace CRT only if one part of display remains out of focus despite adjustments of focus controls to their limits. |
| Flashing or wavy screen or monitor emits high-pitched noise | <ol style="list-style-type: none">1. Reseat analog board.2. Replace analog board. |
| Raster size too short/tall or narrow/wide | <ol style="list-style-type: none">1. Adjust horizontal or vertical size control.2. Reseat analog board.3. Replace analog board. |
| Linearity bad (size of text/graphics differs at top, bottom, or sides of screen) | <ol style="list-style-type: none">1. Reseat analog board.2. Replace analog board. |
| Raster tilted or shifted | <ol style="list-style-type: none">1. Verify that distortion is not due to environmental conditions (move monitor to different location).2. Perform appropriate geometric adjustments.3. Perform yoke adjustments.4. Reseat analog board.5. Replace analog board. |
| Raster distorted (barrel-shaped, corners not square, stretched or compressed at top of display, or sides not perpendicular) | <ol style="list-style-type: none">1. Verify that distortion is not due to environmental conditions (move monitor to different location).2. Perform appropriate geometric adjustments.3. Reseat analog board.4. Replace analog board.5. Replace CRT (only in rare instances). |
| Raster not centered | <ol style="list-style-type: none">1. Verify that distortion is not due to environmental conditions (move monitor to different location).2. Adjust horizontal or vertical center control.3. Reseat analog board.4. Replace analog board. |

Floppy Drive Problems	Solutions
Audio and video are present, but internal floppy drive does not operate.	<ol style="list-style-type: none"> 1. Startup from floppy. 2. Replace bad disk with known-good disk. 3. Reseat floppy drive. 4. Replace floppy drive. 5. Reseat logic board. 6. Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card. 7. Replace floppy drive cable.
Disk ejects; display shows icon with blinking "X"	<ol style="list-style-type: none"> 1. Replace bad system disk with known-good system disk. 2. Replace floppy drive. 3. Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card.
Unable to insert disk all the way	<ol style="list-style-type: none"> 1. To eject previously inserted disk, insert opened paper clip into hole beside floppy drive. 2. Switch off system and hold mouse button down while switching system on (to complete cycle). 3. Replace floppy drive.
Does not eject disk	<ol style="list-style-type: none"> 1. Insert opened paper clip into hole beside floppy drive. 2. Switch off system and hold mouse button down while switching system on (to complete cycle). 3. Replace floppy drive.
Internal floppy drive runs continuously	<ol style="list-style-type: none"> 1. Replace bad disk with known-good disk. 2. Replace floppy drive. 3. Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card. 4. Replace floppy drive cable.
Hard Drive Problems	Solutions
Internal or external hard drive does not operate	<ol style="list-style-type: none"> 1. Startup from floppy. 2. Verify that SCSI loopback card is not attached. 3. Verify that internal hard drive has all three terminating resistor packs on circuit board. 4. Verify that external drive is properly terminated. 5. Replace hard drive. 6. Replace logic board. Retain customer's SIMMs, math coprocessor, and PDS card. 7. Replace hard drive data cable.

-
- Works with internal or external SCSI device but does not work with both
1. Verify that SCSI device ID switch setting on external device is higher than 0. Also verify that ID switch setting on external SCSI device does not duplicate ID switch settings on any other attached external SCSI devices.
 2. Replace terminator on external SCSI device.
 3. Replace SCSI select cable.
 4. Replace logic board.

Peripheral Problems

Solutions

- Cursor does not move
1. Check mouse connection.
 2. If mouse was connected to keyboard, connect it to rear ADB port instead. If mouse works, replace keyboard.
 3. If mouse does not work in any ADB port, replace mouse.
 4. Startup from floppy.
 5. Replace logic board.
- Cursor moves, but clicking mouse button has no effect
1. Startup from floppy.
 2. Replace mouse.
 3. Replace logic board.
- Cannot double-click to open application, disk, or server
1. Startup from floppy.
 2. Remove extra system files on hard drive.
 3. Clear parameter RAM.
 4. If mouse was connected to keyboard, connect it to rear ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse.
 5. Replace logic board.
- No response to any key on keyboard
1. Startup from floppy.
 2. Check keyboard connection to ADB port.
 3. Replace keyboard cable.
 4. Replace keyboard.
 5. Replace logic board.
- Known-good ImageWriter or ImageWriter II does not print
1. Make sure that Chooser and control panel settings are correct.
 2. Replace printer driver and system software with known-good driver and software.
 3. Replace printer interface cable.
 4. Replace logic board.

-
- Known-good LaserWriter does not print
1. Make sure that Chooser and control panel are set correctly.
 2. Replace printer driver and system software with known-good.
 3. Replace AppleTalk box and cables with known-good equipment.
 4. Replace logic board.

Startup Problems

Won't start up from keyboard; power switch is on

Solutions

1. Test battery for 3.6 VDC.
2. Remove battery for 10 minutes, then replace the battery.
3. Replace logic board.
4. Replace analog board.

After turning "on" the power on/off switch, the computer starts up right away, without user touching the power key on the keyboard

1. Check if analog/power supply modules have a black jumper installed at location BD11 (near focus knobs). If present, remove the jumper.
2. Try known-good keyboard and ADB cable.

Computer is dead on arrival

1. Press the keyboard power-on key (this is also the shutdown key).

Miscellaneous Problems

Clicking, chirping, or thumping sound

Solutions

1. Verify that logic board power cable is connected at J12 on logic board.
2. Replace analog board.
3. Replace logic board.

Smoke/odor

1. Replace analog board.

No video, no audio, and no drive operation

1. Connect the power cord.
2. Switch power on.
3. Push Power On key on keyboard.
4. Replace power cord.
5. Replace analog board.
6. Replace logic board.

"Sad Macintosh" icon

1. Restart from Disk Tools disk.
2. Replace RAM SIMMs on logic board.
3. Replace logic board.

Upgrades – Macintosh Color Classic

VRAM Upgrade

The Color Classic has 256K of video RAM (VRAM) soldered on the logic board. You can increase the amount of VRAM to 512K by installing a 256K VRAM SIMM in the SIMM slot (connector J9). Use only 100 ns or faster VRAM SIMMs.

DRAM Upgrade

The Color Classic has 4 MB of RAM soldered on the logic board and can be expanded to 10 MB of RAM. The Color Classic includes one SIMM expansion slot with two 30-pin connectors. The system requires 100 ns or faster RAM SIMMs.

Math Coprocessor Upgrade

You can add a Motorola 68882 math coprocessor to the logic board in the Color Classic, thereby increasing overall system performance. Position the math coprocessor over socket U9 with the beveled edge of the chip toward the large contact connector (J13) at the front of the board. Align the pins in the socket and gently press down the chip. Refer to “Installation Procedures” in Chapter 2, General Information.

PDS Upgrades

The 96-pin processor-direct slot in the Color Classic is compatible with the PDS slot in the Macintosh LC. Currently Apple offers two PDS expansion cards for the Macintosh LC and the Color Classic—the Apple IIe emulation card and the LC Ethernet card.

▲ Warning This product contains high voltage and a high-vacuum picture tube. To prevent serious personal injury or equipment damage, review the CRT safety instructions before performing these procedures.

▲ Caution With the rear housing removed, the metal chassis could short to the bottom of the logic board. Before switching on system power, make sure the chassis is not touching the logic board. To prevent the bottom of the chassis from bucking and touching the logic board, you may want to support the rear corners of the chassis.

Geometry Adjustments

The controls on this monitor require a short hex-head plastic tool to make adjustments. If the tool is long or too thin, it will be too flexible, which will make fine adjustments difficult. Use a short, rigid, hex-head plastic tool to minimize flexing. Do not use metal alignment tools—they are a shock hazard. Start up the computer using MacTest Pro and display the All-White Screen test pattern.

Centering Adjustments

Using a hex-head plastic adjustment tool, adjust the horizontal or vertical center controls (see Figure 3) until the raster is centered in the display area.

Size Adjustments

1. Using a hex-head plastic adjustment tool, adjust the vertical height control (see Figure 3) until the raster is 4.9 inches (\pm 1/16 inch) or 124.5 mm (\pm 1.5 mm). Verify this height.
2. Using a hex-head plastic adjustment tool, adjust the horizontal width control (see Figure 3) until the raster is 6.7 inches (\pm 1/16 inch) or 168.5 mm (\pm 1.5 mm). Verify the width.

Focus

1. Using MacTest Pro, display the Focus test pattern (see Figure 3).
2. Adjust the focus control until the Focus test pattern is as clear as possible.

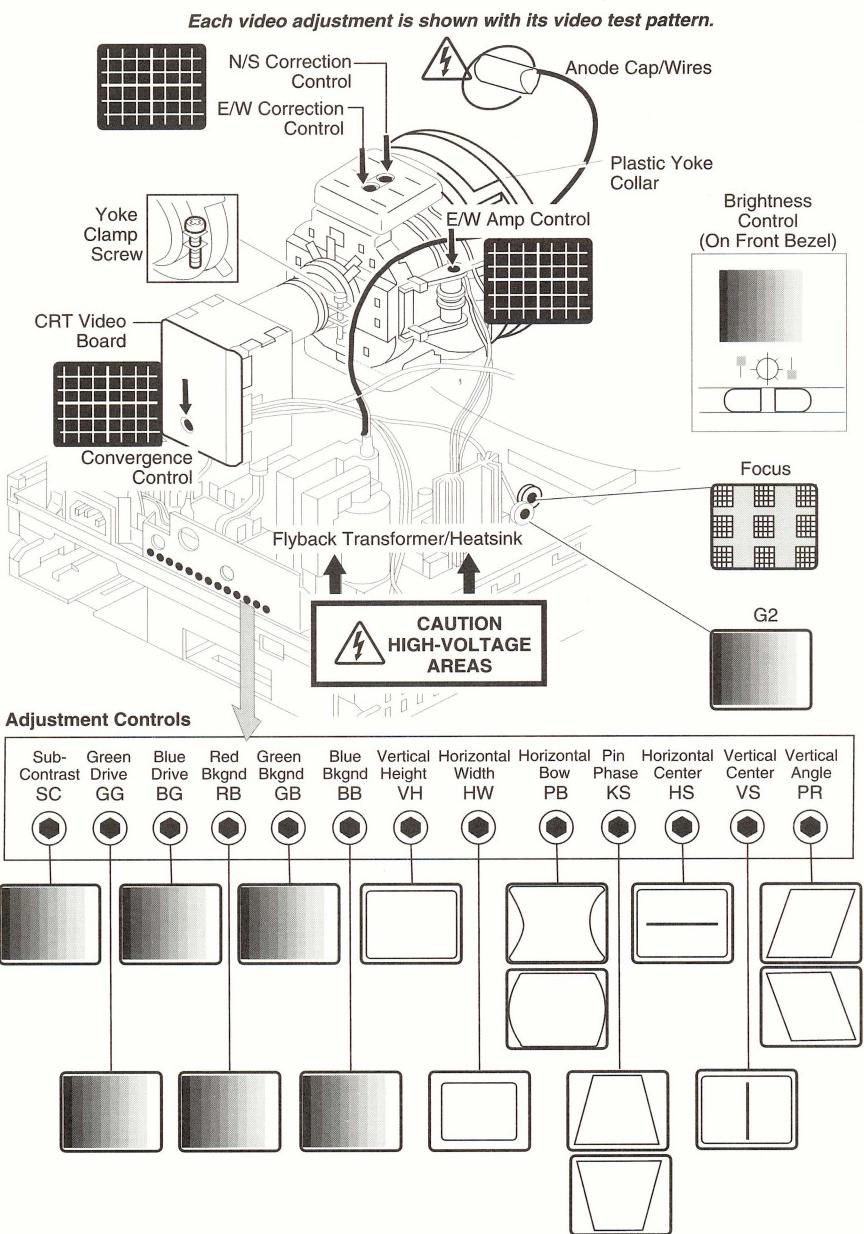


Figure 3 Color Classic Video Adjustments



Cutoff

Note

Perform the cutoff video adjustment whenever you replace the analog board. Also perform the cutoff video adjustment prior to adjusting white balance. Switch on the system at least 10 minutes prior to performing these adjustments.

1. Switch on system power. Using MacTest Pro, display the Gray Bars test pattern.
2. Press the contrast up button and set screen contrast to the maximum.
3. Select the Brightness control panel from the Apple menu. Drag the brightness control to midrange.
4. Using the adjustment tool, set the red, green, and blue background controls to the full counterclockwise positions (Figure 3).
5. Set the green and blue drive controls clockwise to their 3/4 position. (To set the green and blue drive controls to their 3/4 position, turn the controls to their full clockwise position and then turn back 1/4 turn.)
6. Set the sub-contrast control to its full clockwise position (Figure 3).
7. Using a hex-head plastic adjustment tool, adjust G2 until the first bar in the test pattern is completely black and the second bar is barely discernible (Figure 3).
8. Set the sub-contrast control to the center position.

White Balance

Before adjusting the white balance, perform the cutoff video adjustment. Make sure that the:

- Gray Bars test pattern is displayed
 - Contrast is set to maximum
 - Brightness is set to midrange
1. Using a the adjustment tool, alternately adjust the red, green, and blue background controls until there is no predominant color in the four darkest bars. The darkest bar must remain completely black throughout the rest of the procedure. If you notice a predominant color in the darkest bar, readjust the appropriate background control.
 2. If necessary, adjust the blue and green drive controls until there is no predominant color in the four brightest bars.
 3. Check the four darkest bars. If necessary, adjust the red, green, and blue background controls until there is no predominant color.
 4. Using MacTest Pro, display the All-White Screen test pattern.
 5. Using the light meter, adjust the sub-contrast control until the light meter measures at the high end of the 10 scale.

Convergence

1. Remove the rear housing.
2. Switch on system power. Using MacTest Pro, display the Crosshatch 1 test pattern.
3. Using a hex-head plastic adjustment tool, adjust the convergence control (see Figure 3) on the CRT video board for best overall convergence.
4. Using a hex-head plastic adjustment tool, adjust the N/S correction control (Figure 3) for best convergence of horizontal lines at the top and bottom of the screen.
5. Adjust the E/W correction control (Figure 3) for best convergence of vertical lines at the left and right sides of the screen.
6. Adjust the E/W amp control for best convergence of horizontal lines at the left and right sides of the screen.

Geometric Distortion Adjustments

1. Remove the rear housing.
2. To determine which control to adjust, compare the display with the distortions shown in Figure 3.
3. Using a the adjustment tool, adjust the control that is appropriate for the distortion.
4. If the display is so distorted that you can't tell which adjustments to make, perform the adjustments in the following sequence:
 - Pin phase (KS)
 - Vertical angle (PR)
 - Horizontal bow (PB)
5. If the display is still distorted, repeat the vertical angle and pin phase adjustments.
6. If you can't correct the distortion replace the analog board.

Yoke Adjustments

If you replace the CRT, you will probably have to adjust the yoke.

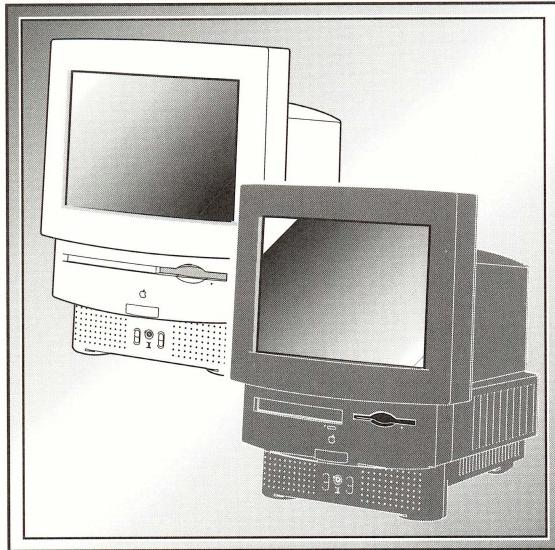
▲ Caution Because you must make yoke adjustments from the rear of the computer, use a mirror to view the computer screen. Do not reach around the computer to adjust collars and rings.

1. Remove rear housing.
2. Using an insulated cross-tip screwdriver, loosen the yoke clamp screw (Figure 3) two or three turns.

▲ Caution With the rear housing removed, the metal chassis could distort the bottom of the logic board. Before switching on system power, make sure the chassis is not touching the logic board. To prevent the bottom of the chassis from buckling and touching the logic board, you may want to support the rear corners of the chassis.

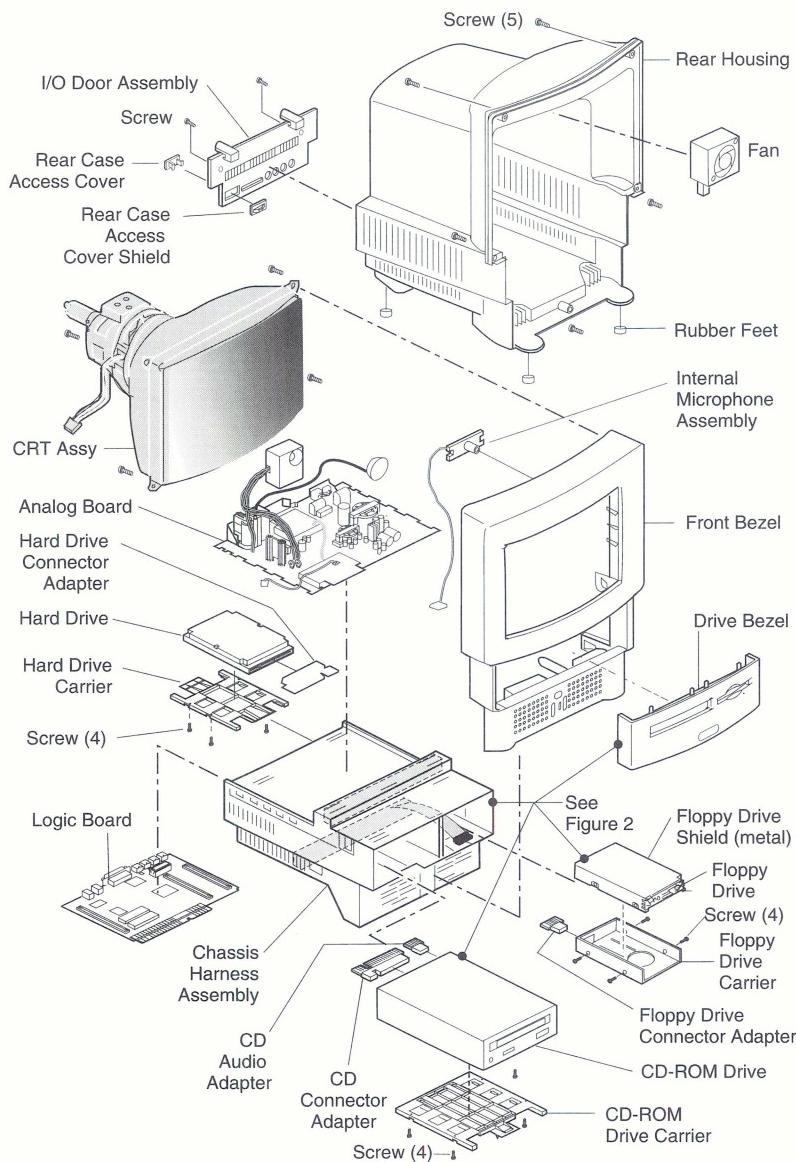
3. Switch on the computer.
4. With one hand, grasp the plastic yoke collar and rotate it until the top and bottom edges of the picture are parallel with the top and bottom of the bezel.
5. Switch off and unplug the computer.
6. Discharge the CRT.
7. Hold the plastic yoke collar in position and carefully tighten the yoke clamp screw so that the collar cannot slip. If the yoke is not positioned close enough to the CRT, screen distortion will occur. Do not overtighten the screw.
8. Replace the rear housing and switch on the computer.
9. Verify that the top and bottom edges of the picture are parallel with the top and bottom of the bezel.

Macintosh LC 520, 550, 575 Performa 550, 560, 575, 577, 578 Macintosh TV



Illustrated Parts List	106
Bezel, Chassis, and Drive Configurations	110
Specifications	112
Symptom/Cure Chart	114
Video Adjustments	120
Additional Information	125
Logic Board Diagrams	126

Illustrated Parts List – LC 520-575; Performa 550-578; Macintosh TV



This is a generic representation of a product family. Configurations may vary.

Figure 1 Exploded View

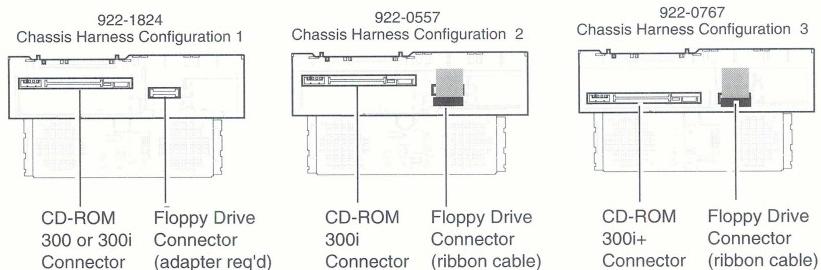
Analog Board	
Analog Board (LC 520-575; Performa 550-578)	661-0813
Analog Board (Mac TV).....	661-0872
CD-ROM	
Carrier, CD-ROM.....	922-0850
CD Audio, Adapter	922-1822
CD Audio Connector (LC 575)	922-0766
CD Connector, Adapter	922-1821
CD 300i Drive Mechanism	661-1646
CD-ROM Drive Mechanism w/o Headphone Board, CD 300 (LC 520/Performa 550/Mac TV)	661-0023
Drive Mechanism, Tray Loading, Apple CD 300i+	661-0222
Hard Drive Connector, Adapter	922-1820
Screw, M 3 x 8 mm, Pan Head w/cap	462-3105
Chassis	
Chassis/Harness Assembly (LC 520/Mac TV)	922-1824
Chassis/Harness Assembly, CD 300i+/Manual Insert Floppy.	922-0767
Chassis Manual Insert Drive, (Perf 550-578/LC 520/550).....	922-0557
CRT Assembly	
9" RGB CRT Assembly, Domestic	661-1666
9" RGB CRT Assembly, Australian (LC 575)	661-1667
9" RGB CRT Assembly, European (LC 575).....	661-1668
Screw, Tap, Hex, Wash, #8-16 (Bag of 6).....	922-0069
Floppy Drive	
Apple SuperDrive 1.4 MB Drive Mech (LC 520/575/Mac TV) .	661-0474
Apple SuperDrive Manual Insert 1.4 MB Drive.....	661-0121
Carrier, SuperDrive	922-1807
Carrier, Floppy, Manual Insert.....	922-0445
1.44 MB Dr. Connector, Adapter (LC 520, 575/Mac TV).....	922-1823
Screws, Plastic Case/ Floppy Carrier	416-1305
Shield, Floppy Drive (LC 520, 575/Mac TV).....	922-1808
Front Bezel	
Drive Bezel w/CD (LC 520, 550)	922-1833
Drive Bezel w/CD (Mac TV)	922-0882
Front Bezel (LC 520-575/Performa 550-578).....	922-1834
Front Bezel, Black (Mac TV)	922-0881
Infrared Receiver Assembly (Mac TV)	922-0880
Internal Microphone (LC 520-575/Performa 550-578)	922-1802
Panel, LC 520, CD 300i/Manual Insert Floppy	922-0444
Panel, LC 520, no CD/Manual Insert Floppy.....	922-0443
Panel, LC 575, CD 300i+/Manual Insert Floppy	922-0765
Panel, LC 575, FD/CD 300i.....	922-0702
Panel, LC 575, FD/CD.....	922-0703

Panel, LC 575, FD	922-0764
Panel, Performa 550, CD/Manual Insert	922-0558
Panel, Performa 575, FD/CD	922-0765
Hard Drive	
Carrier, Hard Drive	922-1806
Carrier, Hard Drive and DDS-DC, 3.5"	922-0621
Hard Drive, 80 MB, 3.5" SCSI	661-0774
Hard Drive, 160 MB, 3.5" SCSI	661-1649
Hard Drive, 320 MB, 3.5" SCSI	661-0505
Hard Drive Connector, Adapter	922-1820
Screws, SEMS 6-32x313 Pn CRS	440-6105
Logic Board	
Battery, Alk., 4.5V, Velcro Mount (LC 575)	922-0750
Ethernet Card, AAUI Port, Comm Slot (LC 575)	661-0889
Ethernet Card, 10 Base-T, Comm Slot (LC 575).....	661-0888
Lithium Battery w/o Leads	742-0011
Logic Board, 25 MHz (LC 520).....	661-0812
Logic Board, 33 MHz (LC 575).....	661-0867
Logic Board, 33 MHz (Performa 550-578/LC 550).....	661-1830
Logic Board, 33 MHz (Mac TV)	661-1724
SIMM, DRAM, 1 MB, 80 ns, 72 pin	661-0734
SIMM, DRAM, 4 MB, 80 ns, 72 pin	661-0808
SIMM, DRAM, 8 MB, 80 ns, 72 pin	661-0809
SIMM, VRAM, 256 Kx4, 80 ns, 68-pin (LC 575).....	661-0893
SIMM, VRAM, 128 K, 80 ns, 68-pin (LC 575)	661-0722
Tuner, PCBA Assembly (Mac TV).....	661-1731
Rear Housing	
Fan Assembly.....	922-1803
I/O Door Assembly (LC 575)	922-0704
I/O Door Assembly (LC 520-575/Performa 550-578)	922-1827
I/O Door Assembly (Mac TV)	922-0884
Rear Case Access Cover (LC 520-575/Performa 550-578)....	815-1154
Rear Case Cover Shield (LC 520-575/Performa 550-578)	805-0137
Rear Housing (LC 520-575/Performa 550-578)	922-1835
Rear Housing (Mac TV).....	922-0883
Rubber Feet	865-0051
Screw, M 3 x 5.8 mm.....	410-1308
Screw, Tap 22 x 1 4 x 16 PN, Torx	426-1007
Miscellaneous	
Accessory Kit, Standard CD (LC 520/Performa 550-578).....	601-0381
Accessory Kit (Performa 550-578)	601-0553
Accessory Kit, Standard CD (Mac TV)	601-0506
ADB Cable, Black (Mac TV)	922-0885

ADB Mouse II (LC 520-575/Performa 550-578)	661-0763
ADB Mouse II, Black (Mac TV).....	661-1723
Apple Keyboard II (LC 575, Performa 550-578).....	661-0603
Apple Keyboard II, Black (Mac TV)	661-1722
Cable, Phone RJ-11, 7 ft. (LC 575)	922-0740
Carrier, Hard Drive and DDS-DC, 3.5" (LC 575)	922-0621
Ethernet, 10 Base-T, Comm Slot (LC 575)	661-0888
Ethernet, AAUI, Comm Slot (LC 575).....	661-0889
Ethernet, Thin Net, Comm Slot (LC 575)	661-0036
Express Modem, 14.4 Baud, Comm Slot (LC 575)	661-0887
Infrared Remote Control (Mac TV)	922-0549
Kit, Software Essentials (Mac TV).....	601-0557
Power Cable, AC, 110V, Smoke (LC 575)	590-0380
Power Cable, Black (Mac TV)	922-0886
Retainer Ring, Mouse II, 35 mm Black (Mac TV).....	922-1112
Screw, Metric, Sems, M 3x.5, Pan (LC 575)	462-3201
Screw, Metric, 3 x 8 mm, Pan Hd. w/Cap (LC 575/LC 520)....	922-0401
Screw, Tap, Hex, Wash. #8-16, 1" (LC 575)	432-2000
Screw, Tap, M 3.5 x1.7 mm, PT (LC 575).....	426-1008

Bezel, Chassis, and Drive Configurations

Figure 2 and the table that follows show the bezels, drive mechanisms, adapters, and chassis configurations used with the Macintosh LC 500 and Performa 500 series computers.



Note that on chassis 922-0767, the CD-ROM connector at the back of the CD-ROM bay is near the floor of the CD-ROM bay, while the connectors in similar chassis are near the top of the CD-ROM bay.

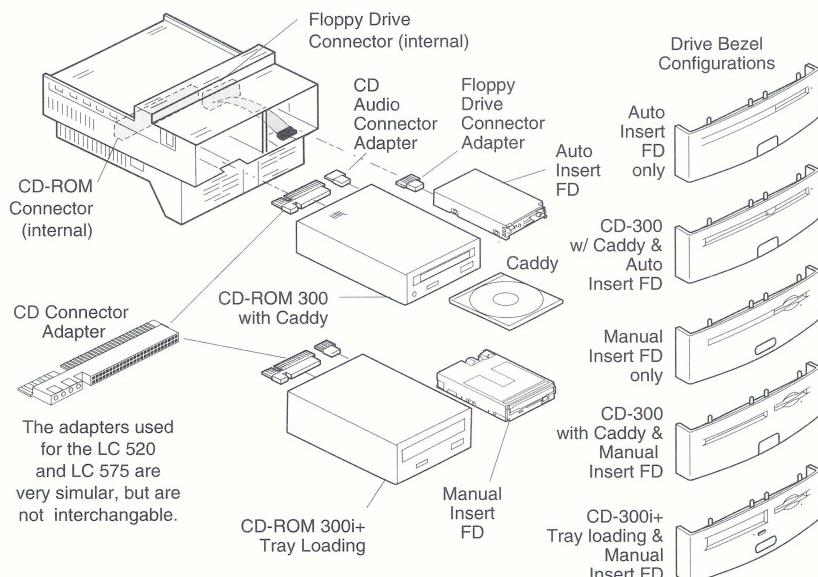


Figure 2 Bezel, Chassis, and Drive Configurations

LC 500 Series/Performa 500 Series/Mac TV Drive Bezel Matrix									
Drive Bezel	Chassis Configuration	CD Adapter	CD Audio Adapter	FD Adapter	CD, Caddy 661-0023*	CD, Caddy 661-1646	661-0222 CD Tray Loading	661-0474 Auto Insert FD	661-0121 Manual Insert FD
		922-1820 922-1821	922-1822 922-0766	922-1823	922-1823	922-1823	922-1823	922-1823	922-1823
LC 520 922-1833	1				■	■		■	
LC 520 922-0443	2		■						■
LC 520 922-0444	2			■					■
LC 575 922-0764	2								■
LC 550 922-0764	2								■
LC 575 922-0765	3	■		■			■		■
LC 575 922-0702	2		■	■		■			■
Performa 550 922-0558	2		■	■		■			■
Performa 550 922-0765	3	■		■			■		■
Performa 560 922-0715	2		■	■		■			■
Performa 575, 577, 578 922-0765	2		■	■		■			■
	3	■		■			■		■
Macintosh TV 922-0882	1	■		■	■	■		■	
*661-0023 CD-ROM w/o Headphone Board.									
922-1824 Chassis Harness Configuration 1									
922-0557 Chassis Harness Configuration 2									
922-0767 Chassis Harness Configuration 3									

Specifications – LC 520-575; Performa 550-578; Macintosh TV

Processor	LC 520: Motorola 68030 microprocessor, 25 MHz; built-in MMU Mac TV: Motorola 68030, 32 MHz; built-in MMU; socket for optional math coprocessor Performa 500 Series/LC 550: Motorola 68030, 33 MHz, built-in MMU; socket for optional math coprocessor LC 575, Performa 575, 577, 578: 68LC040 microcoprocessor, 33 MHz; built-in MMU; socket for optional math coprocessor
Memory	RAM: 4 MB of dynamic RAM on board; 5 MB of dynamic RAM on board (Performa 575, 577); 8 MB of dynamic RAM on board (Performa 578); expandable to 36 MB (8 MB on Mac TV), 80 ns or faster SIMMs, 72-pin DRAM SIMM connector ROM: 1 MB of ROM (expandable to 2 MB on Mac TV) PRAM: 256 bytes of clock/calendar/parameter memory; long-life lithium battery (LC 520, 550), alkaline battery (LC 575) VRAM: 512K, 768K (Performa 575, 577, 578), 1 MB (LC 500 Series); 68-pin VRAM SIMM connector (LC 520/Performa 500 Series); Two VRAM SIMM slots (LC 575)
Disk Storage	Floppy Drive: Internal 1.4 Apple SuperDrive Hard Drive: Internal 80, 160, 250, or 320 MB SCSI hard drive (160 MB on Mac TV) CD-ROM Drive: Internal Apple CD 300i, double-speed CD-ROM drive, Apple CD 300+ CD-ROM drive (LC 550, 575); Internal Apple CD 300+i, double-speed CD-ROM drive (Performa 577, 578)
I/O Interfaces	Serial: Two RS-232/RS-422; mini DIN-8 connectors SCSI: One SCSI parallel port; DB-25 connector ADB: Two ADB ports Processor-Direct Slot: Internal expansion slot for processor-direct expansion card (Performa 500 Series), internal expansion slot for 96 or 114-pin processor-direct expansion cards (LC 500 Series) Communication Slot: Internal expansion for 50-pin modem and Ethernet cards (LC 575/Performa 575, 577, 578) Sound: Sound-output port for stereo sound; sound input port for monoaural sound input; front headphone jack capable of delivering stereo sound
I/O Devices	Keyboard: Apple keyboard with numeric keypad; soft power-on switch; two-level tilt adjustment (Mac TV supports all Apple Desktop Bus keyboards) Mouse: ADB Mouse II; ergonomic design Microphone: Built-in electret, omnidirectional microphone (LC 500 Series/Performa 500 Series) Speaker: Adjustable sound control on front of bezel

Sound and Video	Sound Generator: Records and plays back at 11 kHz or 22 kHz sample rate; two speakers with enhanced stereo sound; allows playback and recording of ordinary audio compact discs Video Display: 14-in diagonal, 13-in viewable screen; Trinitron CRT with high-contrast glass; .26-mm aperture grille pitch; 640 by 480 pixels; 70 dpi
Electrical	Line Voltage: 100-240 VAC; universal power supply Frequency: 47-63 Hz, single phase Maximum Power: 120 W
Physical	Height: 17.9 in. (45.5 cm) Width: 13.5 in. (34.4 cm) Depth: 16.5 in. (42 cm) Weight: 40.5 lb. (18.4 kg)

Symptom/Cure – LC 520-575; Performa 550-578; Macintosh TV

Video Problems	Solutions
Screen is black, too dark, or too bright; audio and drive operate	<ol style="list-style-type: none">1. Adjust contrast button on front bezel.2. Adjust brightness. Use Brightness control panel.3. Check yoke cable connection.4. Perform video adjustments.5. Reseat analog board.6. Replace analog board.7. Replace CRT.
Screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none">1. Perform video adjustments.2. Reseat analog board.3. Replace analog board.4. Replace CRT.
Single vertical or horizontal line displays	<ol style="list-style-type: none">1. Reseat analog board.2. Replace analog board.3. Replace CRT.
Predominant color tint cannot be adjusted	<ol style="list-style-type: none">1. Perform video adjustments.2. Reseat analog board.3. Replace analog board.4. Replace CRT if red, green, or blue cannot be turned off using appropriate controls.
Picture breaks into diagonal lines; or picture rolls vertically or horizontally	<ol style="list-style-type: none">1. Reseat analog board.2. Replace analog board.
Out of convergence (color bleeds from text or lines)	<ol style="list-style-type: none">1. Perform convergence adjustment.2. Reseat analog board.3. Replace analog board.4. Replace CRT.
Black screen spots (burnt phosphors)	<ol style="list-style-type: none">1. Replace CRT.
Screen jitters or flashes	<ol style="list-style-type: none">1. Verify that adjacent computer equipment is properly grounded. Move electrical devices away from monitor. Temporarily shut off all fluorescent lights in area.2. Check that all ground cables are secure.3. Reseat analog board.4. Replace analog board.

Out of focus	<ol style="list-style-type: none"> 1. Perform focus adjustment. 2. Reseat analog board. 3. Replace analog board. 4. Replace CRT only if one part of display remains out of focus despite adjustments of focus controls to their limits.
Flashing or wavy screen or monitor emits high-pitched noise	<ol style="list-style-type: none"> 1. Reseat analog board. 2. Replace analog board.
Raster size too short/tall or narrow/wide	<ol style="list-style-type: none"> 1. Adjust horizontal or vertical size control. 2. Reseat analog board. 3. Replace analog board.
Linearity bad (size of text/graphics differs at top, bottom, or sides of screen)	<ol style="list-style-type: none"> 1. Perform video adjustments. 2. Reseat analog board. 3. Replace analog board.
Raster tilted or shifted	<ol style="list-style-type: none"> 1. Verify that distortion is not due to environmental conditions (move monitor to different location). 2. Perform appropriate geometric adjustments. 3. Perform yoke adjustments. 4. Reseat analog board. 5. Replace analog board.
Raster distorted (barrel-shaped, corners not square, stretched or compressed at top of display, or sides not perpendicular)	<ol style="list-style-type: none"> 1. Verify that distortion is not due to environmental conditions (move monitor to different location). 2. Perform appropriate geometric adjustments. 3. Reseat analog board. 4. Replace analog board. 5. Replace CRT (only in rare instances).
Raster not centered	<ol style="list-style-type: none"> 1. Verify that distortion is not due to environmental conditions (move monitor to different location). 2. Adjust horizontal or vertical center control. 3. Reseat analog board. 4. Replace analog board.

Floppy Drive Problems

Solutions

- Audio and video are present, but internal floppy drive does not operate
1. Replace bad disk with known-good disk.
 2. Replace floppy drive.
 3. Replace logic board. Retain customer's SIMMs.
 4. Replace floppy drive cable.

	Solutions
Audio and video are present, but internal floppy drive does not operate	<ol style="list-style-type: none"> 1. Replace bad disk with known-good disk. 2. Replace floppy drive. 3. Replace logic board. Retain customer's SIMMs. 4. Replace floppy drive cable.
Disk ejects; display shows icon with blinking "X"	<ol style="list-style-type: none"> 1. Replace bad system disk with known-good system disk. 2. Replace floppy drive. 3. Replace logic board. Retain customer's SIMMs.
Unable to insert disk all the way	<ol style="list-style-type: none"> 1. To eject previously inserted disk, insert opened paper clip into hole beside floppy drive. 2. Switch off system and hold mouse button down while switching system on (to complete eject cycle). 3. Replace floppy drive.
Does not eject disk	<ol style="list-style-type: none"> 1. Insert opened paper clip into hole beside floppy drive. 2. Switch off system and hold mouse button down while switching system on (to complete cycle). 3. Replace floppy drive.
Internal floppy drive runs continuously	<ol style="list-style-type: none"> 1. Replace bad disk with known-good disk. 2. Replace floppy drive. 3. Replace logic board. Retain customer's SIMMs. 4. Replace floppy drive cable.
Hard Drive Problems	
Internal or external hard drive does not operate	<ol style="list-style-type: none"> 1. Verify that SCSI loopback card is not attached. 2. Verify that external drive is properly terminated. 3. Replace hard drive. 4. Replace logic board. Retain customer's SIMMs. 5. Replace hard drive data cable.
Works with internal or external SCSI device but does not work with both	<ol style="list-style-type: none"> 1. Verify that SCSI device ID switch setting on external device is higher than 0. Also verify that ID switch setting on external SCSI device does not duplicate ID switch settings on any other attached external SCSI device. 2. Replace terminator on external SCSI device. 3. Replace SCSI select cable.

CD-ROM Drive Problems	Solutions
CD-ROM drive does not accept disc	1. Replace disc (if dirty or damaged).
Volume control does not operate correctly	1. Replace chassis harness assembly.
Macintosh cannot mount CD-ROM drive	1. Replace CD-ROM drive mechanism.
Peripheral Problems	Solutions
Cursor does not move	1. Check mouse connection. 2. If mouse was connected to keyboard, connect it to rear ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 3. Replace logic board. Retain customer's SIMMs.
Cursor moves, but clicking mouse button has no effect	1. Replace mouse. 2. Replace logic board. Retain customer's SIMMs.
Cannot double-click to open application, disk, or server	1. Remove extra system files on hard drive. 2. Clear PRAM. 3. If mouse was connected to keyboard, connect it to rear ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Retain customer's SIMMs.
No response to any key on keyboard	1. Check keyboard connection to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Replace logic board. Retain customer's SIMMs.
Known-good ImageWriter or ImageWriter II does not print	1. Make sure that Chooser and control panel settings are correct. 2. Replace printer driver and system software with known-good driver and software. 3. Replace printer interface cable. 4. Replace logic board. Retain customer's SIMMs.

Startup Problems	Solutions
Won't start up from keyboard; power switch is on	<ol style="list-style-type: none"> 1. Remove the battery for 10 minutes, then reinstall the battery. 2. Clear the parameter RAM
After turning on the power on/off switch, the computer starts up right away, without user touching the power key on the keyboard	<ol style="list-style-type: none"> 1. Check if analog/power supply modules have a black jumper installed at location BD11 (near focus knobs). If present, remove the jumper.
Computer is dead on arrival	<ol style="list-style-type: none"> 1. Press the keyboard power-on key (this is also the shutdown key).
Miscellaneous Problems	Solutions
Clicking, chirping or thumping sound	<ol style="list-style-type: none"> 1. Replace analog board. 2. Replace logic board. Retain customer's SIMMs.
Smoke/odor	<ol style="list-style-type: none"> 1. Replace analog board.
No video, no audio, and no drive operation	<ol style="list-style-type: none"> 1. Connect power cord. 2. Switch power on. 3. Replace power cord. 4. Replace analog board. 5. Replace logic board. Retain the customer's SIMMs.
"Sad Macintosh" icon	<ol style="list-style-type: none"> 1. Replace bad disk with known-good disk. 2. Replace RAM SIMMs on logic board. 3. Replace logic board. Retain the customer's SIMMs.
Screen shows "Sad Macintosh" icon and black vertical lines; screeching sound	<ol style="list-style-type: none"> 1. Replace RAM SIMMs on logic board. 2. Replace logic board. Retain the customer's SIMMs.

-
- | | |
|---|---|
| Headphone jack does not operate correctly | 1. Verify that headphone jack is seated properly.
2. Replace chassis harness assembly. |
| Speaker jacks do not operate | 1. Verify that speaker jacks are seated properly.
2. Replace chassis harness assembly. |
| Mac TV remote powers up the computer but doesn't provide any control after that | 1. Clear PRAM.
2. After hearing the second startup chord, release the keys. |

▲ Warning This product contains high voltage and a high-vacuum picture tube. To prevent serious personal injury or equipment damage, review the CRT safety instructions in Chapter 1, CRT and ESD Safety.

▲ Caution With the rear housing removed, the metal chassis could short to the bottom of the logic board. Before switching on system power, make sure the chassis is not touching the logic board. To prevent the bottom of the chassis from bucking and touching the logic board, you may want to support the rear corners of the chassis.

Geometry Adjustments

The controls on this monitor require a short hex-head plastic tool to make adjustments. If the tool is long or too thin, it will be too flexible, which will make fine adjustments difficult. Use a short, rigid, hex-head plastic tool to minimize flexing. Do not use metal alignment tools—they are a shock hazard. Startup the computer using MacTest Pro and display the All-White Screen test pattern.

Centering Adjustments

Using a hex-head plastic adjustment tool, adjust the vertical and horizontal controls (Figure 3) until the raster is centered in the display area.

Size Adjustments

1. Adjust the vertical height control (see Figure 3) until the raster is 4.9 inches (\pm 1/16 inch) or 124.5 mm (\pm 1.5 mm). Verify this height.
2. Adjust the horizontal width control (see Figure 3) until the raster is 6.7 inches (\pm 1/16 inch) or 168.5 mm (\pm 1.5 mm).

Focus

Using MacTest Pro, display the Focus test pattern. Adjust the focus control until the Focus test pattern is as clear as possible (see Figure 3).

Each video adjustment is shown with its video test pattern.

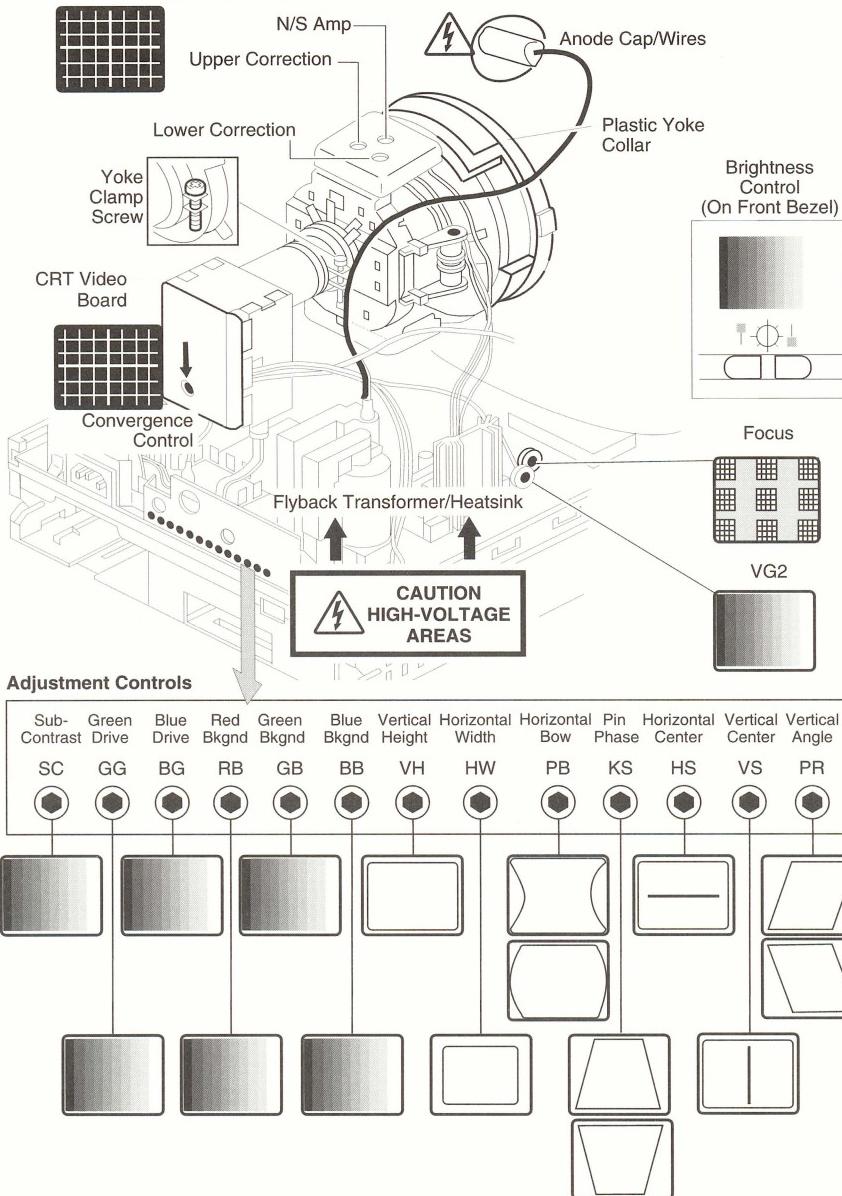


Figure 3 Video Adjustments

Cutoff

Perform the cutoff video adjustment whenever you replace the analog board. Also, perform the cutoff video adjustment prior to adjusting white balance. Switch on the system at least 10 minutes prior to performing these adjustments.

1. Using MacTest Pro, display the Gray Bars test pattern.
2. Press the contrast up button and set screen contrast to the maximum.
3. Select the Brightness control panel from the Apple menu. Drag the brightness control to midrange.
4. Set the red, green, and blue background controls (see Figure 3) to the full counterclockwise positions.
5. Set the green and blue drive controls clockwise to their 3/4 position. To do this, turn the green and blue drive controls to their full clockwise position and then turn back 1/4 turn.
6. Set the subcontrast control to its full clockwise position.
7. Adjust VG2 until the first bar in the test pattern is completely black and the second bar is barely discernible.
8. Set the subcontrast control to the center position.

White Balance

Before adjusting the white balance, perform the cutoff video adjustment and make sure that the:

- Gray Bars test pattern is displayed
 - Contrast is set to maximum
 - Brightness is set to midrange
1. Note the predominant color.
 2. Alternately adjust the red, green, and blue background controls until there is no predominant color in the four darkest bars. The darkest bar must remain completely black throughout the rest of the procedure. If you notice a predominant color in the darkest bar, readjust the appropriate background control.
 3. If necessary, adjust the blue and green drive controls (Figure 3) until there is no predominant color in the four brightest bars.
 4. Check the four darkest bars. If necessary, adjust the red, green, and blue background controls until there is no predominant color.
 5. Using MacTest Pro, display the All-White Screen test pattern.
 6. Using the light meter, adjust the subcontrast control until the light meter measures at the high end of the 10 scale.

Convergence

1. Remove the rear housing.
2. Switch on system power. Using MacTest Pro, display the Crosshatch 1 test pattern.
3. Adjust the convergence control (see Figure 3) on the CRT video board for best overall convergence.
4. Adjust the N/S amp control (see Figure 3) for best convergence of horizontal lines at the top and bottom of the screen.
5. Adjust the lower correction control for best convergence of vertical lines at the left and right sides of the screen.
6. Adjust the upper correction control for best convergence of horizontal lines at the left and right sides of the screen.

Geometric Distortion Adjustments

Perform the following geometric adjustments to correct distortions other than geometric center, size, and focus problems.

1. Remove the rear housing.

▲ Warning

The entire yoke assembly has very high voltage. To prevent electrical shock, do not touch the yoke assembly, the anode wire, or the yoke wires.

2. Use MacTest Pro to display the Crosshatch 1 test pattern.
3. Verify that the boxes on the top row are the same size as the boxes on the bottom row, and the boxes on the left side are the same size as the boxes on the right side.
4. To determine which control to adjust, compare the display with the distortions shown in Figure 3.
5. Using a hex-head plastic adjustment tool, adjust the appropriate control (see Figure 3 for control locations).
6. If the display is so distorted that you can't tell which adjustments to make, perform the adjustments in the following sequence:
 - Pin phase (KS)
 - Vertical angle (PR)
 - Horizontal bow (PB)
7. If the display is still distorted repeat the vertical angle and pin phase adjustments.
8. If you can't correct the distortion, replace the analog board.

Yoke Adjustments

▲ **Caution** With the rear housing removed, the metal chassis could distort the bottom of the logic board. Before switching on system power, make sure the chassis is not touching the logic board. To prevent the bottom of the chassis from buckling and touching the logic board, you may want to support the rear corners of the chassis.

If you replace the CRT, you will probably have to adjust the yoke.

1. Remove the rear housing.
2. Using an insulated cross-tip screwdriver, loosen the yoke clamp screw two or three turns.
3. Switch on the computer.
4. With one hand, grasp the plastic yoke collar and rotate it until the top and bottom edges of the picture are parallel with the top and bottom of the bezel.
5. Switch off and unplug the computer.
6. Discharge the CRT.
7. Hold the plastic yoke collar in position and carefully tighten the yoke clamp screw so that the collar cannot slip. **Do not overtighten** the screw. If the yoke is not positioned close enough to the CRT, screen distortion will occur.
8. Replace the rear housing and switch on the computer.
9. Verify that the top and bottom edges of the picture are parallel with the top and bottom of the bezel.

Identifying Features

The LC 575 logic board includes a 68LC040 processor, an additional Comm slot, and a new hook-and-loop attached battery. The LC 520 and LC 550 do not include these features.

The LC 550 and LC 575 ship with the newer manual-insert 1.4 MB Apple SuperDrive and require the keyhole-shaped bezel.

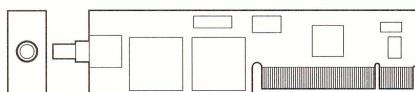
Compatibility Notes

You can exchange (replace) the chassis harness assembly 922-1824 with the chassis harness assembly 922-0557 for the manual insert floppy drive. These are not replaceable by chassis 922-0767, which is for the caddyless CD-ROM drive.

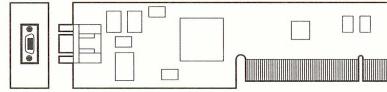
Communications Slot

A flexible communications slot on the LC 575 allows either Ethernet networking or the connection of a high-speed fax/modem, without occupying the processor-direct slot. (See Figure 4).

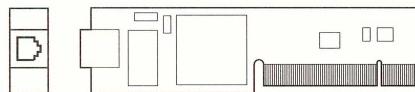
Macintosh LC 575
Ethernet Card, Thin-net, Comm Slot



Macintosh LC 575
Ethernet Card, AAUI, Comm Slot



Macintosh LC 575
Ethernet Card, 10 Base-T, Comm Slot



Macintosh LC 575
Express Modem, 14.4 Baud, Comm Slot

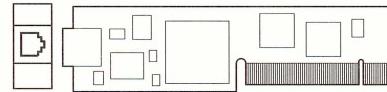
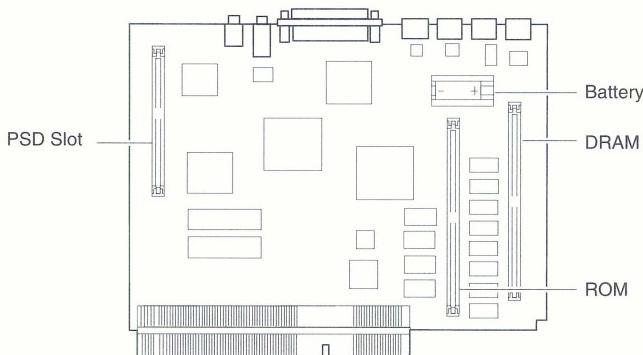


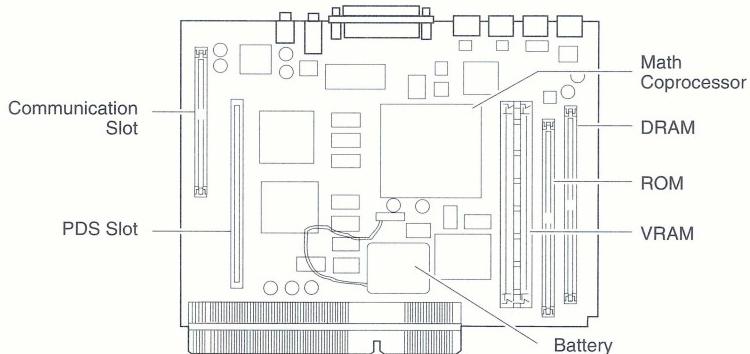
Figure 4 Communications Slot Cards

Logic Board Diagrams

LC 520, 550, Performa 550, 560



Performa 575/577/578



Macintosh TV

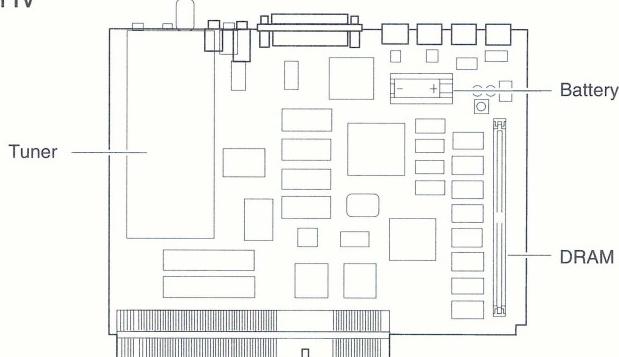
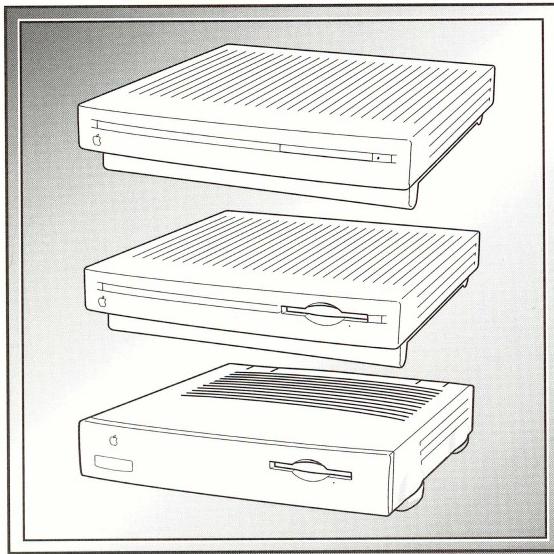


Figure 5 Logic Boards

Macintosh LC III, 475

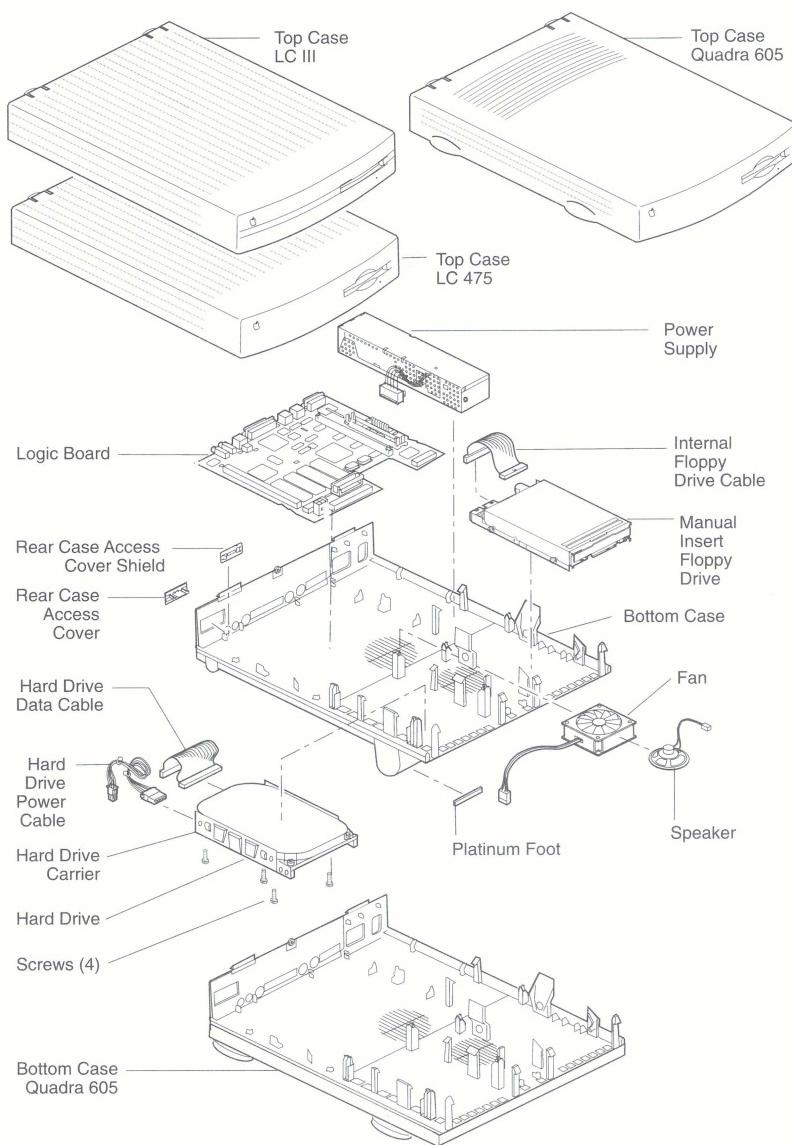
Performa 405, 410, 430, 450, 460, 466, 467, 475, 476

Macintosh Quadra 605



Illustrated Parts List	128
Specifications	132
Product Comparison	134
Symptom/Cure Chart	135
Additional Procedures	140
Macintosh LC Upgrades	141
Logic Board Diagrams	143

Illustrated Parts List – LC III, 475; Performa 405-476; Quadra 605



This is a generic representation of a product family. Configurations may vary.

Figure 1 Exploded View

Bottom Case Assembly	
Battery, Lithium (w/o Leads).....	742-0011
Bottom Case (LC 475).....	630-0500
Bottom Case (Performa 400 Series).....	630-0501
Bottom Case (Quadra 605)	630-0583
Fan Assembly.....	600-0193
Foot, Platinum	865-0066
Power Supply, HBF (Performa 450 & 460 Series)	661-0787
Power Supply, 36 Watt (LC 475/Performa 470 Series).....	661-1733
Rear Case Access Cover Shield	805-0137
Rear Case Access Cover	815-1154
Speaker Assembly	609-0003
Drives	
Apple SuperDrive 1.4 MB Drive Mechanism	661-0474
Apple SuperDrive Manual Insert 1.44 Floppy Disk Drive	661-0121
Cable, 1.4 MB, FDHD, Internal.....	590-0524
Cable, HDA, Power	590-0303
Cable, Internal, HDA, SCSI	590-0228
Carrier, 1.4 MB Apple SuperDrive.....	805-0961
Disk Drive Slot Cover (Performa 400 Series).....	815-1164
Disk Drive Slot Cover Shield (Performa 400 Series).....	805-1527
Drive Carrier, HDA, 3.5" SCSI, Internal.....	805-0980
HDA, 40 MB, 3.5" SCSI (LC III, 475).....	661-0112
HDA, 1" 40 MB, 3.5" SCSI.....	661-0614
HDA, 40 MB, 3.5" SCSI.....	661-0773
HDA, 1" 80 MB, 3.5" SCSI.....	661-0624
HDA, 80 MB, 3.5" SCSI.....	661-0111
HDA, 80 MB, 3.5" SCSI.....	661-0774
HDA, 120 MB, 3.5" SCSI (Performa 400 Series)	661-0021
HDA, 160 MB, 3.5" SCSI (LC III, 475).....	661-1647
HDA, 160 MB, 3.5" SCSI	661-1649
HDA, 230 MB, 3.5" SCSI	661-1637
HDA, 250 MB, 3.5" SCSI, Unhoused	661-0890
Screw, 6 - 32 x .250 (HDA Carrier to HDA).....	444-6104
Screw (SuperDrive Carrier to SuperDrive)	844-0018
Logic Boards	
Logic Board 4 MB (Performa 460 Series)	661-1736
Logic Board (LC II, Performa 450)	661-0720
Logic Board (LC 475/Quadra 605/Performa 470 Series)	661-1732
SIMM, DRAM, 1 MB, 80 ns, 72-Pin.....	661-0734
SIMM, DRAM, 1 MB 8 ns (Uses Two 4 MB Chips)	661-0719
SIMM, DRAM, 1 MB, 80 ns	661-0520
SIMM, DRAM, 2 MB, 80 ns	661-0643

SIMM, DRAM, 4 MB, 80 ns	661-0808
SIMM, DRAM, 8 MB, 80 ns, 72-Pin (2 M x 32).....	661-0809
SIMM, VRAM, 256K, 80 ns, 68-Pin.....	661-0722
SIMM, VRAM, 512K	661-0649
SIMM, VRAM, 512K, 80 ns	661-1021
Top Case Assembly	
Disk Drive Slot Cover	815-1164
Disk Drive Slot Cover Shield	805-1527
Label, Performa 410 (Bag of 10)	922-0553
Label, Performa 460 (Bag of 10)	922-0552
Label, Performa 466 (Bag of 10)	922-0550
Label, Performa 467 (Bag of 10)	922-0551
Label, Performa 476 (Bag of 10)	922-0556
Label, Product ID (LC III).....	922-0448
Label, Product ID (LC 475) (Bag of 10).....	922-0699
Label, Product ID (Quadra 605)	922-0584
Microphone Assembly (Performa 400 Series).....	699-5071
Microphone Assembly (LC Series).....	922-0867
Top Case (Performa 405).....	922-2031
Top Case (Performa 430).....	922-2032
Top Case (Performa 450).....	922-2033
Top Case (LC III)	922-0199
Top Case, (LC III with Manual Insert Floppy Drive)	922-0548
Top Case (Quadra 605)	922-0582
Miscellaneous	
Apple Ethernet LC Card	661-0621
Apple IIe Card	661-0595
Apple Keyboard II	661-0603
Assy, Ethernet LC Card, Standoffs, 10 set.....	076-0543
Cable, Apple IIe Card	590-0703
Connector, Jumper (LC 400 Series/Quadra 605).....	517-0546
Display, 14" Color Monitor, .39 Dot (Performa 400 Series)....	661-1670
Internal SCSI Terminator.....	630-0408
LC Ethernet ROM Upgrade Kit (LC 400 Series/Quadra 605)....	922-0002
Mouse, Apple Desktop Bus	661-0113
Mouse, Apple Desktop Bus II	661-0763
Mouse Ball (21.9 mm Diameter), Black	699-8038
Mouse Ball (22.23 mm Diameter), Gray	922-0349
Mouse Ball (25.4 mm Diameter), Gray	699-8001
Power Cable, AC 110 V, Smoke	590-0380
Retainer, ADB Mouse (for 21.9 mm Black Mouse Ball)	815-0816
Retainer, ADB Mouse (for 669-8038 Ball)	922-0350
Retainer, ADB Mouse II (for 22.23 mm Gray Mouse Ball)	922-0345

Retainer, Snap-On, ADB Mouse (for 669-8001)	815-1136
Retainer, Twist-On, ADB Mouse (for 669-8001)	076-0231
Screw, Cover.....	430-1031
Self-Terminating Cable, 2-meter, Ethernet.....	076-0540
Self-Terminating Cable, 5-meter, Ethernet.....	076-0541
Self-Terminating Cable, Plenum, 13-meter, Ethernet	076-0542
Svc. Pkg., 800K/Apple SuperDrive.....	602-0210
Svc. Pkg., HDA 3.5", 1" High Drives w/o Carriers (Also for 19 mm High Floppy Drive).....	602-0308
Thin Coax Transceiver, Ethernet.....	630-8503

Specifications – LC III, 475; Performa 405-476; Quadra 605

Processor	Performa 405/410/430: 68030 microprocessor; 16 MHz; 16-bit internal data bus; burst-mode RAM access LC III/Performa 450: Motorola 68030 microprocessor; 25 MHz; 32-bit internal data bus; burst-mode RAM access; coprocessor socket Performa 460/466/467: Motorola 68030 microprocessor; 33 MHz; 32-bit internal data bus; burst-mode RAM access; coprocessor socket LC 475/Quadra 605/Performa 475/476: Motorola 68LC040 microprocessor; 25 MHz; 32-bit internal data bus; burst-mode RAM access
Memory	DRAM: 4 MB standard, expandable to 10 MB–100 ns or faster SIMMs (Performa 405/410/430); 4 MB standard, expandable to 36 MB–80 ns or faster SIMMs (LC III/Performa 450/460/466/467); 4 MB or 8 MB standard, expandable to 36 MB–80 ns or faster SIMMS (LC 475/Quadra 605/Performa 475/476) ROM: 1 MB (LC III/LC 475/Quadra 605/Performa 450/460/466/467/475/476) PRAM: 256 bytes of clock/calendar/parameter memory; long-life lithium battery VRAM: 512K VRAM SIMM (Performa 400/405/410/430); 512K VRAM on-board upgradable to 768 MB (LC III/Performa 460/466/467); 512K VRAM SIMM upgradable to 768 MB (Performa 450) 512K VRAM SIMM upgradable to 1 MB (LC 475/Quadra 605/Performa 475/476)
Disk Storage	Floppy Drive: Apple SuperDrive 1.4 MB Floppy Drive (LC III/ Performa 405/430/450); Apple SuperDrive Manual Insert Floppy Drive (Performa 410/460/466/467); Apple SuperDrive 1.4 MB Floppy Drive or Apple SuperDrive Manual Insert Floppy Drive (LC 475/Quadra 605/ Performa 475/476) Hard Drive: 40 MB or 80 MB (Performa 400); 80 MB (Performa 405/410); 120 MB (Performa 430); 40, 80, or 160 MB (LC III); 120 or 180 MB (Performa 450); 160 MB (Performa 466/467/475); 180 MB (Performa 460); 160 or 230 MB (LC 475/Quadra 605/ Performa 476)
I/O Devices	Keyboard: Apple Keyboard, Apple Keyboard II, Apple Extended Keyboard II, or Apple Adjustable Keyboard connected through ADB ports (mini DIN-4) Mouse: ADB Mouse and ADB Mouse II connected through ADB ports (mini DIN-4) Microphone: Electret, omnidirectional; operates on 8 VDC supplied by microphone on CPU Speaker: Adjustable sound control on front of bezel

I/O Interfaces	Serial: Two RS-232/RS-422; mini DIN-8 connectors SCSI: SCSI interface; DB-25 connector ADB: One ADB port; mini DIN-4 connector Video: One DB-15 monitor port or built-in video; DA-15 connector Sound: Mono sound input and output port; mini phono plug (LC III/Performa 400 Series); mono sound input port; stereo output; mini phono plug (LC 475/Quadra 605/Performa 475/476) Expansion Connector: 96-pin PDS supporting 020/030 direct-slot expansion card (Performa 405/410/430); 114-pin PDS supporting 020/030 direct slot expansion card (LC III/Performa 450/460/466/467); 144-pin expansion slot supporting 030/040 expansion cards; accepts Macintosh LC compatible I/O display, network and video capture cards; does not support 030 processor accelerator or cache cards, (LC 475/Quadra 605/ Performa 475/476)
Sound and Video	Sound: Monoaural, 8-bit sound input at 11 or 22 kHz; monophonic, 8-bit sound generator supplying same signal to both channels or stereo equipment (LC 400 Series/Performa Series); stereo output capability (Quadra 605) Performa 405/410/460/, bundled with Performa Display .39 VGA monitor Performa 430/450/466/467/475/476, bundled with Performa Display .29 VGA monitor LC III, LC 475, and Quadra 605 provide up to 16-bit support on 12-,13-, and 16-inch monitors and 8-bit support on 15-inch portrait and 21-inch monitors. LC III, LC 475, and Quadra 605 support all Apple monitors available at CPU introduction dates; support NTSC and PAL standards
Electrical	Line Voltage: 100-240 VAC, automatically configured Frequency: 47-63 Hz (LC 400 Series); 50-60 Hz (Quadra 605/ Performa Series) Maximum Power: 30 W (LC III/Performa 450); 26 W (Quadra 605/ Performa 475/476)
Physical	Height: 3.0 in (7.7 cm) Width: 12.2 in. (31.0 cm) Depth: 15.0 in. (38.2 cm) Weight: 8.8 lb. (4.0 kg)

Product Comparison – LC III, 475; Performa 475, 476; Quadra 605

	LC III	LC 475	Perf. 475	Perf. 476	Quad. 605
Market	Schools	Schools	Home	Home	Business
Processor	68030	68LC040	68LC040	68LC040	68LC040
Clock	25 MHz	25 MHz	25 MHz	25 MHz	25 MHz
FPU	Yes	No ¹	No ¹	No ¹	No ¹
Std. RAM	4 MB	4 MB	4 MB	4 MB	4 MB
Max. RAM	36 MB				
Std. Hard Drive	80 MB	80/160 MB	160 MB	230 MB	80/160 MB
Display	no ²	no ²	yes ²	yes ²	no ²
Display Support	Up to 16"	All Apple displays	All Apple displays	All Apple displays	All Apple displays
VRAM	512/1MB	512/1MB	512/1MB	512/1MB	512/1MB
Colors	256 ³ Up to 16-bit on 14"	256 ⁴ Up to 16-bit on 16"	256 ³ Up to 16-bit on 14"	256 ³ Up to 16-bit on 14"	256 ³ Up to 16-bit on 14"
PDS	1 LC PDS	1 LC III-Compact PDS	1 LC III-Compact PDS	1 LC III-Compact PDS	1 LC III-Compact PDS
Modem	No	No	Yes	Yes	No
System Software	7.1	7.1	7.1P	7.1P	7.1
Bundled Apps	No	No	Yes ⁵	Yes ⁵	No

- 1 These systems come with a 68LC040 that has no FPU. A qualified technician can remove the 68LC040 and replace it with a 68040RC, which includes an FPU; Apple neither offers nor supports such an upgrade.
- 2 The Performa models are bundled with the Macintosh Performa Display; the LC models can be used with a variety of Apple and third-party displays.
- 3 Can be upgraded to 32,000 colors with VRAM upgrade from 512K to 768K.
- 4 Can be upgraded to 32,000 colors with VRAM upgrade from 512K to 1 MB.
- 5 The Performa models are shipped with a selection of application software appropriate to the target market and resale channel.

Symptom/Cure – LC III, 475; Performa 405-476; Quadra 605

Error Chords	Solutions
Eight-tone error sounds during startup (LC III/475/Quadra 605/Performa 400 series)	<ol style="list-style-type: none">1. Replace SIMMs.2. Replace logic board. Retain customer's SIMMs.3. Perform SIMM verification on replacement logic board.
Four-tone error chord sounds during startup (Performa 400 series)	<ol style="list-style-type: none">1. Disconnect hard drive power cable and hard drive data cable and reboot system. If startup sequence is normal, run Macintosh Hard Disk Test and replace hard drive if necessary.2. Disconnect floppy drive cable and reboot system. If startup sequence is normal, replace floppy drive.3. Replace logic board. Retain customer's SIMMs.
Built-in Video Problems	Solutions
Screen is dark, audio and at least one drive operate, fan runs, and LED is lit	<ol style="list-style-type: none">1. Adjust brightness on monitor.2. Replace monitor. Troubleshoot defective monitor.3. Replace video cable.4. Replace logic board. Retain customer's SIMMs.5. Replace power supply.
Screen is dark, audio and drive do not operate, but fan runs and LED is lit	<ol style="list-style-type: none">1. Remove expansion card, if present.2. Remove peripherals.3. Replace SIMMs.4. Replace logic board. Retain customer's SIMMs.5. Replace power supply.
Partial or whole screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none">1. Replace video cable.2. Replace monitor.3. Replace logic board. Retain customer's SIMMs.
Screen is completely dark, fan is not running, and LED is not lit	<ol style="list-style-type: none">1. Plug monitor directly into wall socket. Verify that monitor has power.2. Remove expansion card, if present.3. Remove peripherals.4. Replace power supply.5. Replace logic board. Retain customer's SIMMs.
Vertical lines, horizontal lines, or snow appears on screen, or screen is completely dark; startup tone is normal	<ol style="list-style-type: none">1. Replace video cable.2. Replace monitor.3. Replace VRAM SIMM.4. Replace logic board. Retain customer's SIMMs.5. Replace power supply.

Floppy Drive Problems	Solutions
Audio and video are present, but internal drive does not operate	<ol style="list-style-type: none"> 1. Try known-good Disk Tools disk. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Replace logic board. Retain customer's SIMMs.
Disk ejects; display shows icon with blinking "X"	<ol style="list-style-type: none"> 1. Replace disk with known-good system disk. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Replace logic board. Retain customer's SIMMs.
Disk does not eject	<ol style="list-style-type: none"> 1. Switch off system and hold mouse button down while switching system on (to complete eject cycle). 2. Eject disk manually by inserting an open paper clip into hole beside drive slot. 3. Replace floppy drive cable. 4. Replace floppy drive.
Drive attempts to eject disk, but doesn't	<ol style="list-style-type: none"> 1. Push disk completely in. 2. Eject disk manually by pushing opened paper clip into hole beside drive slot. 3. Check that cover is completely on. 4. Replace floppy drive.
Hard Drive Problems	Solutions
Internal hard drive runs continuously	<ol style="list-style-type: none"> 1. Startup from Disk Tools disk or CD. 2. Make sure system is version 7.1 or later. 3. Replace internal hard drive. 4. Replace logic board. Retain customer's SIMMs.
Internal hard drive does not operate	<ol style="list-style-type: none"> 1. Replace hard drive data cable. 2. Replace hard drive power cable. 3. Replace internal hard drive. 4. Replace logic board. Retain customer's SIMMs.

Peripheral Problems	Solutions
Works with internal or external SCSI device but does not work with both	<ol style="list-style-type: none"> 1. Startup from Disk Tools or CD. 2. Verify that SCSI select switch on external device is set to different priority from internal. 3. Verify that both ends of external SCSI device are terminated. 4. Replace terminator on external SCSI device. 5. Verify that terminator is installed on internal SCSI drive. 6. Replace SCSI select cable.
Cursor does not move	<ol style="list-style-type: none"> 1. Reboot system. 2. Check mouse connection. 3. If mouse was connected to keyboard, connect it to rear ADB port and disconnect keyboard. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Retain customer's SIMMs.
Cursor moves, but clicking mouse button has no effect	<ol style="list-style-type: none"> 1. Replace mouse. 2. Replace logic board. Retain customer's SIMMs.
Cannot double-click to open application, disk, or server	<ol style="list-style-type: none"> 1. Remove extra system files on hard drive. 2. Clear parameter RAM. 3. If mouse was connected to keyboard, connect it to rear ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port, replace mouse. 4. Replace logic board. Retain customer's SIMMs.
No response to any key on keyboard	<ol style="list-style-type: none"> 1. Make sure system is version 7.1 or later. 2. Check keyboard connection to ADB port. 3. Replace keyboard cable. 4. Replace keyboard. 5. Replace logic board. Retain customer's SIMMs.
Known-good ImageWriter or ImageWriter II does not print	<ol style="list-style-type: none"> 1. Make sure that Chooser and control panel settings are correct. 2. Make sure system is version 7.1 or later. 3. Check printer DIP switches. 4. Replace printer interface cable. 5. Replace logic board. Retain customer's SIMMs.

Miscellaneous Problems	Solutions
Known-good LaserWriter does not print	<ol style="list-style-type: none"> 1. Make sure that Chooser and control panel settings are correct. 2. Make sure system is version 7.1 or later. 3. Refer to Networks manual on <i>Service Source CD</i>.
Clicking, chirping, or thumping sound	<ol style="list-style-type: none"> 1. Replace power supply. 2. Disconnect hard drive. Replace drive if noise disappears. 3. Replace logic board. Retain customer's SIMMs.
System shuts down intermittently	<ol style="list-style-type: none"> 1. Make sure air vents on back and top of case are unobstructed. Thermal protection circuitry may shut down computer. After 30 to 40 minutes, system should be OK. 2. Replace power cable. 3. Replace power supply. 4. Replace SIMMs. 5. Replace logic board. Retain customer's SIMMs.
System intermittently crashes or locks up	<ol style="list-style-type: none"> 1. Make sure system is version 7.1 or later. 2. Make sure software is known-good. 3. Replace logic board. Retain customer's SIMMs. 4. Replace SIMMs. 5. Replace power supply.
No sound from speaker	<ol style="list-style-type: none"> 1. Verify that Volume control panel setting is 1 or above. 2. Replace speaker. 3. Replace logic board. Retain the customer's SIMMs.
Clock doesn't run	<ol style="list-style-type: none"> 1. Replace battery. See "Battery and AC Adapter Verification" in Chapter 2, General Information. 2. Replace logic board. Retain customer's SIMMs.
System seems to boot; then message "Finder is old version" displays	<ol style="list-style-type: none"> 1. Clear parameter RAM. 2. Replace logic board. Retain customer's SIMMs.

-
- | | |
|---|--|
| System intermittently doesn't power on | <ol style="list-style-type: none">1. Check cables.2. Plug monitor directly into wall socket. Verify that monitor has power.3. Replace power cord.4. Check batteries. See "Battery and AC Adapter Verification" in Chapter 2, General Information.5. Replace logic board. Retain customer's SIMMs.6. Replace power supply. |
| Monitor raster width too narrow | <ol style="list-style-type: none">1. Refer to Adjustments section in appropriate Monitor manual on <i>Service Source CD</i> for horizontal size (width) adjustment. |
| System hangs or crashes | <ol style="list-style-type: none">1. If using an older LC Ethernet card, with a computer running System 7, disable virtual memory.2. Performa 400 Series: upgrade the ROMs on the Ethernet card.
LC Series/Qudra 605: clear parameter RAM.3. LC 400 Series/Qudra 605: upgrade to latest revision of software.4. LC 400 Series/Qudra 605: replace logic board. |
| System doesn't recognize more than 10 MB of RAM | <ol style="list-style-type: none">1. Although you can install up to 12 MB of RAM in Performa 400/405/410/430 computers, 10 MB is the maximum amount of RAM that the system recognizes. |



Additional Procedures

Grounding Connector Replacement

The replacement logic boards for the LC 475 and the Quadra 605 do not include grounding connectors. You must remove the grounding connector from the defective board and install it on the replacement board. There are two versions of the grounding connectors, a foam pad and a connecting grounding spring. You may encounter either version on the LC 475 and Quadra 605 logic boards.

Install the connecting grounding spring on the audio ports of the replacement logic board with the arms of the spring facing out. Install the foam grounding pad on the audio ports with the rough side of the pad facing out (Figure 2).

If for some reason you do not have the grounding spring, you must order this part separately.

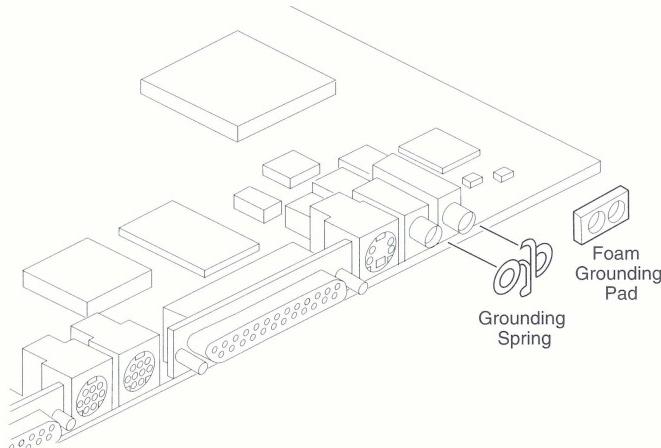


Figure 2 Grounding Spring and Foam Grounding Pad

Quadra 605 Logic Board Jumper Replacement

The LC 475 and the Quadra 605 use the same replacement logic board. The Quadra 605 requires a jumper to connect the pins at location J18. Quadra 605 service replacement logic boards do not include the jumper.

If you are replacing a Quadra 605 logic board, remove the jumper from the pins at location J18 on the defective board and install the jumper on the pins at location J18 on the replacement logic board.

Macintosh LC Upgrades

- ▲ **Caution** To prevent ESD damage to components, wear a grounding wriststrap. Review the ESD precautions in Chapter 1, CRT and ESD Safety.
- ▲ **Caution** Make sure that the connections to the sound out and sound input ports are correct. Inserting equipment into the wrong port can damage the computer or equipment.

LC to LC III Upgrade

A Macintosh LC upgrade kit upgrades a Macintosh LC to a Macintosh LC III. The upgrade kit includes a top cover, fan, speaker, floppy drive carrier, and Macintosh LC III logic board. The following procedures explain how to remove the LC parts and install them into the LC III upgrade unit.

1. Remove the cover, fan/speaker assembly, floppy drive, hard drive, and logic board.
2. Install the LC floppy drive and cable into the new LC III floppy drive carrier. If you are installing a replacement auto-inject 1.4 MB SuperDrive, you must remove the dust shield, if present.
3. Install the Macintosh LC III logic board.
4. Install the LC VRAM SIMMS and the expansion card (if present) into the LC III upgrade logic board.

Note

DRAM SIMMS from an LC are not compatible with the LC III.

5. Install and connect the new floppy drive carrier, hard drive with carrier and cables, speaker, fan, and Macintosh LC III top cover.

LC II to LC III Upgrade

A Macintosh LC III upgrade kit upgrades a Macintosh LC II to a Macintosh LC III. The upgrade kit includes a Macintosh LC III logic board, top cover, fan, speaker, and floppy drive carrier. However, when upgrading an LC II to an LC III, you will need only two parts from the upgrade kit—the LC III logic board and the LC III top cover.

1. Remove the cover, fan, floppy drive, hard drive, and LC II logic board.
2. Install the Macintosh LC III logic board. Make sure that the connections to the sound out and sound input ports are correct. Inserting equipment into the wrong port can damage the computer or equipment.
3. Install and connect the fan, floppy drive, and hard drive.
4. Install the Macintosh LC III top cover.



LC 475 Upgrade

A Macintosh LC 475 upgrade kit upgrades a Macintosh LC II or LC III to a Macintosh LC 475. The upgrade kit includes a Macintosh LC 475 logic board and product ID labels.

1. Remove the cover, fan, floppy drive, hard drive, and logic board.
2. Before installing the upgrade logic board, install the connecting grounding spring on the audio ports of the board with the arms of the spring facing out (Figure 2). The upgrade kit does not include a connecting grounding spring. You must order this part separately.
3. Install the Macintosh LC 475 logic board.
4. Install and connect the fan, floppy drive, and hard drive.
5. Install the top cover.

LC Ethernet Upgrade

An internal processor-direct slot lets you add capabilities to Macintosh LC computers, such as the Ethernet networking card. The LC Ethernet Card package includes only the LC Ethernet Card. Standoffs are also needed to complete the upgrade. Failure to install the standoffs can cause the computer to restart intermittently. You must order them separately from the card.

1. Remove the top cover.
2. Insert the two standoffs in the appropriate hole locations on the Ethernet card (Figure 3).
3. Position the card so that the external connector extends through the expansion connector opening on the bottom case.
4. Pivot the card over the expansion slot and press the connector pins into the connector slot. Do not force the card into the slot. If you meet a lot of resistance, pull the card out and reseat.

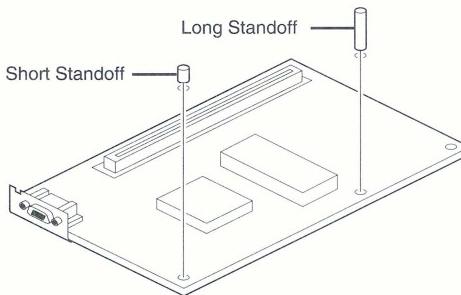
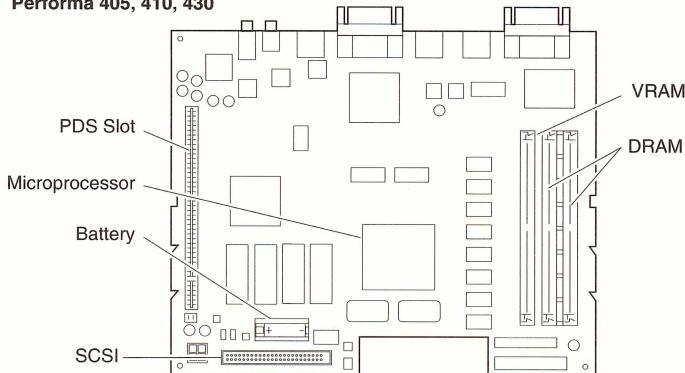


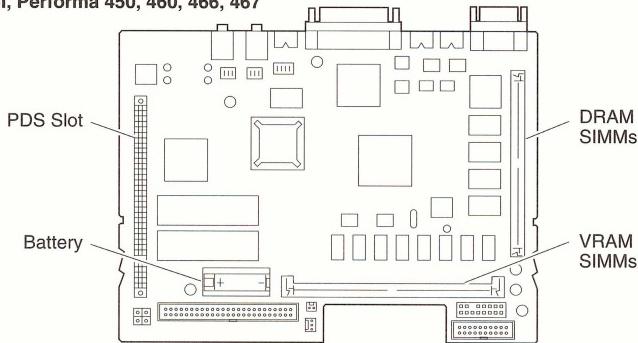
Figure 3 Ethernet Upgrade

Logic Board Diagrams

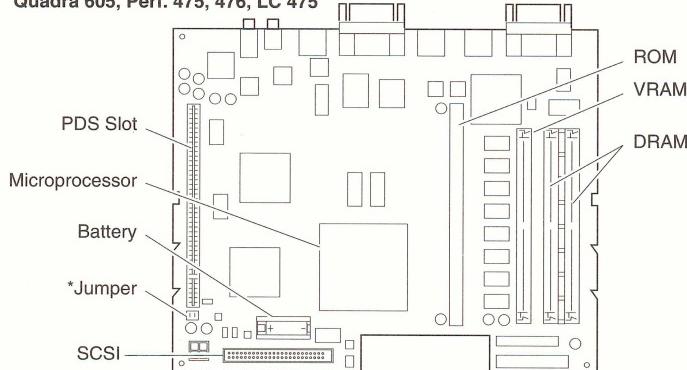
Performa 405, 410, 430



LC III, Performa 450, 460, 466, 467



Quadra 605, Perf. 475, 476, LC 475



* Note: With jumper Q605. Without jumper LC 475

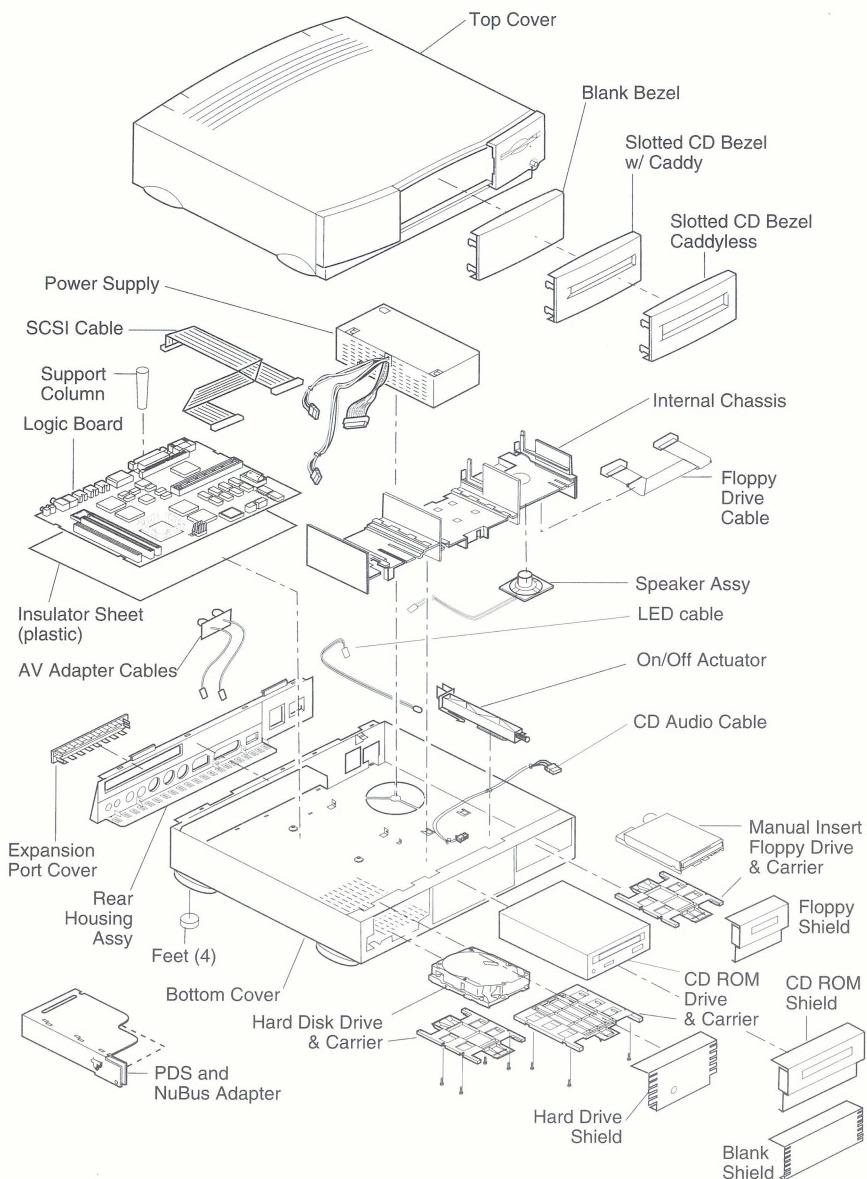
Figure 4 Logic Boards

Macintosh Quadra 610, 660AV Power Macintosh 6100 WS 60, WS 6150



Illustrated Parts List	146
Specifications – Quadra 610, 660AV; WS 60	150
Specifications – Power Macintosh 6100; WS 6150	152
Symptom/Cure Chart – Quadra 660AV	154
Troubleshooting Tips – Power Macintosh 6100; WS 6150	159
Symptom/Cure Chart – Quadra 610; Power Macintosh 6100; WS 60, WS 6150	160
Additional Procedures	164
Upgrades	167
Macintosh Cards	171
Logic Board Diagrams	172

Illustrated Parts List – Quadra 610, 660AV; Power Macintosh 6100; WS 60, WS 6150



This is a generic representation of a product family. Configurations may vary.

Figure 1 Exploded View

Note On November 8, 1993, the Centris name was discontinued from the Macintosh product line. The Centris 610 was replaced by the similar, but faster Quadra 610. The Centris 660AV was changed to the Quadra 660AV.

Bottom Case

Bottom Housing.....	922-0360
Bottom Housing (Power Macintosh).....	922-0806
Insulator Sheet (Centris 610/WS 60).....	922-0361
Insulator Sheet, Pkg. of 10 (Power Macintosh)	922-0808
Insulator Sheet (Quadra 660AV/Centris 660AV).....	922-0866
On/Off Actuator	922-0357
Rear Housing Assembly (Centris 610).....	922-0365
Rear Housing Assembly (Power Macintosh).....	922-0720
Rear Panel (Quadra 660AV/Centris 660AV)	922-0864

Drives

Apple SuperDrive, 1.4 MB Drive Mechanism	661-0474
Apple SuperDrive, Manual Insert Drive (Power Macintosh)....	661-0121
Cable, CD-ROM, Audio	922-0842
Cable, SCSI Drive	922-0352
Cable, SCSI Drive (Power Macintosh)	922-0804
Carrier, CD-ROM.....	922-0850
Carrier, Hard Drive and DDS-DC, 3.5" (Power Macintosh)	922-0621
Carrier, HDA.....	922-1806
CD Caddy.....	678-5059
Drive Mechanism, AppleCD 300	661-1646
Drive Mech. w/o Head Phone Board, CD 300.....	661-0023
Drive Mech. Trayloading, CD 300+ (Power Macintosh)	661-0222
HDA, 80 MB, 3.5" SCSI.....	661-0111
HDA, 80 MB, 3.5" SCSI.....	661-0774
HDA, 160 MB, 1" High, 3.5" SCSI	661-1649
HDA, 230 MB, 3.5" SCSI.....	661-1637
HDA, 250 MB, 3.5" SCSI (Power Macintosh).....	661-0890
HDA, 500 MB, 3.5" SCSI.....	661-0781
HDA, 500 MB, 3.5" SCSI (Power Macintosh).....	661-0891
Shield, 3.5" Drive Bay (Quadra 660AV/Centris 660AV)	805-0961
Shield, 5.25" Drive Bay.....	922-0366
Shield, CD-ROM Drive	922-0400
Shield, CD-ROM, Trayloading, Pkg. of 10 (Power Macintosh).....	922-0826
Shield, Floppy Drive, Pkg. of 10 (Power Macintosh)	922-0809
Shield, Hard Drive Bay	922-0367
Top Cover, Manual Insert Floppy	922-0545

Internal Chassis

Cable, LED, Power.....	922-0354
------------------------	----------

Cable, Floppy Drive.....	922-0351
Chassis, Drive Assembly (Quadra 660AV/Centris 660AV)	922-0359
Speaker Assembly	922-0353
Logic Board	
Column, Top Cover Support.....	922-0356
Logic Board, 20 MHz, 4 MB (Centris 610).....	661-1681
Logic Board, 20 MHz w/Ethernet, 4 MB (Centris 610)	661-1682
Logic Board, 25 MHz, 4 MB (Centris 660AV).....	661-1704
Logic Board, w/o FPU (Quadra 610)	661-0042
Logic Board, w/FPU, Ethernet (Quadra 610)	661-0043
Logic Board (Power Macintosh and WS 6150)	661-1022
NuBus Adapter (Centris 610)	661-1718
NuBus Adapter (Centris 660AV)	661-1719
NuBus Adapter (Power Macintosh)	661-0049
PC 486 Card, DOS Compatible (Quadra 610)	661-1017
Power Macintosh AV Card (Power Macintosh 6100/60/AV) ...	661-1023
SIMM, 4 MB, 80 ns, 72-pin.....	661-0808
SIMM, 8 MB, 80 ns, 72-pin.....	661-0809
SIMM, 8 MB, 60 ns (Quadra 660AV/Centris 660AV)	661-1702
SIMM, 16 MB, 80 ns, 72-pin (Power Macintosh & WS 6150)..	661-0087
SIMM, VRAM, 128K, 80 ns, 68-pin (Quadra 610/WS 60)	661-0722
SIMM, 256K Cache (Power Macintosh)	661-1024
Top Cover	
Bezel, Blank	922-0358
Bezel, CD, Slotted.....	922-0355
Bezel, CD, Trayloading (Power Macintosh)	922-0805
Housing, Top Cover Assembly.....	922-0368
Housing, Top Cover (Power Macintosh)	922-0807
Miscellaneous	
Battery, Lithium	742-0011
Cable, AC Power Cord (Quadra 660AV/Centris 660AV),.....	590-0760
Cable, AC Power Cord, Int'l. (Quadra 660AV/Centris 660AV)	922-0094
Cable, AC Power (Power Macintosh).....	590-0380
Cable, British Power Cord (Quadra 660AV/Centris 660AV)....	590-0091
Cable, Composite Video (Quadra 660AV/Centris 660AV)	922-0870
Cable, DIN7, S-Vid to Comp. Video In (Power Macintosh)	922-0816
Cable, DIN7, S-Vid to Comp. Video Out (Power Macintosh)	922-0817
Cable, DOS Compatible (Quadra 610).....	922-0706
Cable, HDI-45 to DB-15 Display Adapter (Power Macintosh) .	922-0721
Clip, ESD Floppy, Bag of 10 (Centris 660AV)	922-0879
Cover, Battery Holder.....	520-0344
Expansion Plug, Pkg. of 5	922-0902
Express Bracket, DOS Compatible (Quadra 610).....	922-0708

Foot, Enclosure	922-0862
Label, Name Plate (Centris 610)	922-0364
Label, Name Plate (WS 60).....	922-0623
Label, Name Plate (Quadra 660AV).....	922-0865
Label, Product ID, Bag of 10 (WS 60).....	922-0624
Label, Product ID, Bag of 10 (Centris 660AV).....	922-0364
Label, Product ID, Bag of 10 (Centris 660AV, Europe)	922-0878
Label, Product ID, Bag of of 10 (Power Macintosh)	922-0827
Microphone Assembly.....	699-5103
Microphone Assembly, Apple PlainTalk (Power Macintosh) ...	922-0867
Mouse, Apple Desktop Bus II	661-0763
Name Plate, Pkg. of 10 (Power Macintosh 6100/60)	922-0719
Name Plate, Pkg. of 10 (Power Macintosh 6100/60/AV).....	922-0828
PDS Adapter (Power Macintosh)	922-0768
Power Cable, AC, 110 V, Smoke	590-0380
Power Supply, 86 Watt.....	661-1688
Retainer, ADB Mouse II, Black for 21.9 Mouse Ball.....	922-0350
Screw, CD-Carrier	922-0401
Screw, M 3 x .5 x 8 mm.....	410-1308
Screw, Metric, Mach, 3 x 6 mm.....	416-1306
Screw, NuBus Adapter Brck. (Quadra 660AV/Centris 660AV)450-0032	
Screw, SEMS 6-32 x 0.313, HDA.....	440-6105
Screw, SuperDrive	844-0018
Telecom Adapter (Power Macintosh)	661-1703

Specifications – Quadra 610, 660AV; WS 60

Processor	Centris 610: Motorola 68LC040; 20 MHz, built-in memory management unit (MMU) Quadra 610/WS 60: Motorola 68LC040 or 68040; 25 MHz, built-in memory management unit Quadra 610, DOS Compatible: Motorola 68LC040; 25 MHz, built-in memory management unit; DOS compatible card DOS compatible card: 486SX microprocessor, 25 MHz, 32-bit addressing, 32-bit data paths Quadra 660AV/Centris 660AV: Motorola 68LC040; 25 MHz; built-in paged memory management unit (PMMU); floating-point unit (FPU), and 8K memory cache; AT&T DSP3210 32-bit floating-point digital signal processor; Peripheral Subsystem Controller (PSC) provides direct memory access (DMA) between the 68040 buses and peripheral devices
Memory	RAM (Quadra 610/Quadra 660AV/Centris 660AV): 4 or 8 MB RAM, expandable to 68 MB (80 ns or faster 72-pin SIMM) RAM (WS 60): 8 MB RAM , expandable to 68 MB (80 ns or faster 72-pin SIMM) ROM: 1 MB PRAM: 256 bytes VRAM (Centris 610/Quadra 610/WS 60): 512K, expandable to 1 MB (80 ns or faster 68-pin SIMM) VRAM (Quadra 660AV): 1 MB Clock/Calendar: Custom chip with long-life lithium battery
Disk Storage	Floppy Drive: 1.4 Apple SuperDrive Hard Drive (Quadra 610/Quadra 660AV): 80 to 500 MB Hard Drive (WS 60): 230 MB or 500 MB CD-ROM Drive: Optional 5.25-in. CD-ROM drive
I/O Interfaces	ADB: Two ADB ports; mini DIN-4 connectors Serial: Two RS-232/RS-422 ports; mini DIN-8 connectors SCSI: One port; DB-25 connector Expansion Slot (Quadra 610/WS 60): Internal expansion slot supports either a processor-direct slot card or 7-in. NuBus card Expansion Slot (Quadra 660AV): Internal expansion slot supports either NuBus, processor-direct slot (PDS) card, or digital audio/video expansion (DAVE) card with appropriate adapter Sound: 16-bit stereo sound input/output ports Video: One DB-15 video port for built-in video; VGA and SVGA monitors require a special adapter cable, NTSC, and PAL monitor support (Quadra 660AV only) Ethernet: On-board Ethernet; AAUI-15 connector (optional on Centris 610)
I/O Devices	Keyboard: Standard or extended keyboard, draws 25-80 mA Mouse: ADB mouse, draws up to 80 mA Microphone: Standard (Quadra 610); Apple PlainTalk (Quadra 660AV) Maximum Power Draw for all ADB Devices: 500 mA

Sound and Video	Sound: Custom digital Apple sound chip (ASC) Video Display: Support Macintosh 12" Monochrome Display, Macintosh 12" RGB Display, Apple Color High-Res RGB 14" Monitor, Apple AudioVision 14 Display, Macintosh Color Display, Macintosh 15" Portrait Display, Macintosh 16": Color Display, Apple Multiple Scan 17" Display, Apple Two-Page 21" Monochrome monitor, and Macintosh 21" Color Display; NuBus video cards allow computer to support other non-Apple VGA, NTSC, and PAL monitors; supports VGA monitors (640 x 480 only) and SVGA monitors (800 x 600 only) with appropriate adapter cable; Quadra 660AV supports S-Video input/output ports, composite video input/output ports
Electrical	Line Voltage: 100-240 VAC Frequency: 50-60 Hz Input Power: 210 W Output Power: 86 W
Physical	Height: 3.4 in. (85 mm) Width: 16.3 in. (415 mm) Depth (Quadra 610, WS 60): 4.2 in. (107 mm) Depth (Quadra 660AV; Power Macintosh 6100; WS 6150): 15.6 in. (399 mm) Weight: 14.0 lb. (6.4 kg)

Specifications – Power Macintosh 6100; WS 6150

Processor	60 MHz PowerPC 601 RISC microprocessor, built-in MMU and FPU; 32K of on-chip cache memory, requires system software version 7.1.2 or later
Memory	RAM: 8 MB standard, expandable to 72 MB via two SIMM slots; SIMMs must be 80 ns or faster, noncomposite and installed in pairs Cache: 32K of on-chip cache; optional 256K level 2 cache available ROM: 4 MB Clock/Calendar: Custom chip with long-life lithium battery VRAM: None (6100/60 & 6150); 2 MB on Power Macintosh AV Card (6100/60AV)
Disk Storage	Floppy Drive: 1.4 MB Apple SuperDrive Manual Insert Hard Drive: 160 or 250 MB ; 250 MB (6100/60AV) CD-ROM Drive: Internal AppleCD 300+optional on 6100/60 & 6150; standard on 6100/60AV
I/O Interfaces	ADB: One ADB port; mini DIN-4 connector Serial: Two RS-232/RS-422 LocalTalk/GeoPort serial ports; mini DIN-9 connectors (backward compatible with mini DIN-8) SCSI: One SCSI port; DB-25 connector Expansion Slot: One internal slot that accommodates either a PDS card or a 7-in. NuBus card (6100/60 & 6150); 6100/60AV ships with Power Macintosh AV Card installed in expansion slot. Sound: One 16-bit stereo output port; one 16-bit stereo input port Video: One HDI-45 DRAM-based video port for direct connection to Apple AudioVision monitors (6100/60 & 6150); 6100/60AV also includes VRAM-based DB-15 port and and one S-video input and one S-video output port. Ethernet: One built-in AAUI-15 Ethernet port
I/O Devices	Keyboard: Standard or extended keyboard, draws 25-80 mA Maximum Power Draw for ADB Devices: 500 mA Mouse: ADB Mouse II, draws up to 10 mA Microphone: Apple PlainTalk microphone; unidirectional and optimized for use with speech recognition (optional on 6100/60 & 6150; standard on 6100/60AV)
Video Display	Supports Macintosh 12" Monochrome Display, Macintosh 12" RGB Display, Apple Color High-Res RGB 14" Monitor, Apple AudioVision 14 Display, Macintosh Color Display, Macintosh 15" Portrait Display, Macintosh 16" Color Display; 6100/60AV also supports Macintosh 19" Color Display, Apple Multiple Scan 20" Display, Macintosh 21" Color Display, NTSC, and PAL

Electrical	Line Voltage: 100-240 VAC Frequency: 50-60 Hz Input Power: 210 W Output Power: 86 W
Physical	Height: 3.4 in. (85 mm) Width: 16.3 in. (415 mm) Depth: 15.6 in. (399 mm) Weight: 14.0 lb. (6.4 kg)

Symptom/Cure Chart – Quadra 660AV

Video Problems	Solutions
Computer starts up with an "X" displayed through the video icon	<ol style="list-style-type: none">1. The AudioVision monitor requires a system extension in the system folder. The extension did not load properly. Install the AudioVision extension software. Turn off the monitor for at least 30 seconds before restarting.
Screen is black, audio and at least one drive operate, fan is running, and LED is lit	<ol style="list-style-type: none">1. Check video cable connection.2. Adjust brightness on monitor.3. Verify that monitor is switched on.4. Reset clock chip.5. Clear parameter RAM. Make sure Caps Lock key is up.6. Replace video cable.7. Replace monitor.8. Replace video card, if present.9. Replace SIMMs.10. Replace logic board. Move customer's SIMMs to new logic board.11. Replace power supply.
Screen is black, audio and drive do not operate, but fan is running and LED is lit	<ol style="list-style-type: none">1. Remove peripherals.2. Remove expansion card.3. Replace DRAM SIMMs.4. Replace VRAM SIMMs.5. Replace logic board. Move customer's SIMMs to new logic board.6. Replace power supply.
Partial or whole screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none">1. Replace video cable.2. Replace monitor.3. Replace video card, if installed.4. Clear parameter RAM. Make sure Caps Lock key is up.5. Replace logic board. Move customer's SIMMs to new logic board.
Floppy Drive Problems	Solutions
Audio and video present, but internal floppy drive does not operate	<ol style="list-style-type: none">1. Replace disk with known-good disk.2. Verify that all external SCSI devices are disconnected.3. Replace floppy drive cable.4. Replace floppy drive.5. Replace logic board. Move customer's SIMMs to new logic board.6. Replace power supply.
Disk ejects, display shows	<ol style="list-style-type: none">1. Replace disk with known-good system disk.

icon with blinking "X"	2. Replace internal floppy drive cable. 3. Replace internal floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Does not eject disk	1. Switch off computer. Hold mouse button down while you switch computer on. 2. Replace floppy drive cable. 3. Replace internal floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Attempts to eject disk, but doesn't	1. Push disk completely in. 2. Replace internal floppy drive cable. 3. Replace internal floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Drive does not recognize MS-DOS disks	1. To read and write MS-DOS files, format all disks with MS-DOS drive first.

SCSI Drive Problems Solutions

Drive does not appear on the desktop	1. Verify that there are no duplicate SCSI device addresses. 2. Clear parameter RAM. Make sure Caps Lock key is up. 3. Verify that drive is initialized. If it isn't, use HD SC Setup to initialize drive. 4. Replace SCSI data cable. 5. Replace hard drive.
Works with internal or external SCSI device, but does not work with both	1. Verify that each SCSI device is set to a unique SCSI ID number. 2. Verify that hard drive is terminated but optional CD-ROM drive is not terminated. 3. Replace terminator on external hard drive. 4. Replace SCSI select cable on external SCSI device.

CD-ROM Drive Problems Solutions

CD-ROM drive does not accept a compact disc	1. Exchange disc (if disc is dirty or damaged). 2. Replace CD-ROM drive mechanism.
---	---

Peripheral Problems	Solutions
Macintosh does not display CD-ROM drive icon	<ol style="list-style-type: none"> 1. Verify that CD-ROM extension is in System Folder. 2. Reinstall CD software. 3. Replace SCSI data cable. 4. Replace CD-ROM drive mechanism. 5. Replace logic board. Move customer's SIMMs to new logic board.
Compact disc won't eject from the drive	<ol style="list-style-type: none"> 1. Manually eject the compact disc. 2. Press the eject button behind the front bezel (if it is accessible). 3. Replace the CD-ROM drive mechanism.
Cursor moves, but clicking mouse button has no effect	<ol style="list-style-type: none"> 1. Replace mouse. 2. Replace logic board. Move customer's SIMMs to new logic board.
Cursor does not move	<ol style="list-style-type: none"> 1. Check mouse connection. 2. Inspect inside of mouse for buildup of dirt or other contaminants. Clean mouse if necessary. 3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard or ADB cable. If mouse does not work in any ADB port on computer, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
Cannot double-click to open application, disk, or server	<ol style="list-style-type: none"> 1. Remove duplicate System files from hard drive. 2. Clear parameter RAM. Make sure Caps Lock key is up. 3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard or ADB cable. If mouse does not work in any ADB port on computer, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
No response to any key on the keyboard	<ol style="list-style-type: none"> 1. Check keyboard connection to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Replace logic board. Move customer's SIMMs to new logic board.

System Problems	Solutions
Known-good serial printer will not print	<ol style="list-style-type: none"> 1. Reinstall printer drivers. 2. Verify that system software is correct version. 3. Make sure Chooser and control panel settings are correct. 4. Clean install system software and printer drivers. 5. Replace printer interface cable. 6. Replace logic board. Move customer's SIMMs to new logic board.
Known-good printer on a network will not print	<ol style="list-style-type: none"> 1. Verify that system software is correct version. 2. Make sure Chooser and control panel settings are correct. 3. Clean install of system software and printer drivers. 4. Replace logic board. Move customer's SIMMs to new logic board.
Power supply clicks or chirps	<ol style="list-style-type: none"> 1. Replace power supply. 2. Replace logic board. Move customer's SIMMs to new logic board.
Does not power on; screen is black, fan is not running, and LED is not lit	<ol style="list-style-type: none"> 1. Check cables. 2. Plug monitor directly into wall socket and verify that monitor has power. 3. Replace power cord. 4. Replace logic board. Move customer's SIMMs to new logic board. 5. Replace power supply.
System shuts down intermittently	<ol style="list-style-type: none"> 1. Make sure air vents are clear. Thermal protection circuitry may shut down system. After 35 to 40 minutes, system should be OK. 2. Replace power cord. 3. Reset the logic board. (See "Additional Procedures.") 4. Replace logic board. Move customer's SIMMs to new logic board. 5. Replace power supply.
System intermittently crashes or locks up	<ol style="list-style-type: none"> 1. Verify that system software is correct version. 2. Verify that application software is known-good. 3. Replace SIMMs. 4. Reboot the computer with Extensions off by holding down Shift key during startup. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply. 7. Replace hard disk.

Error Chords	Solutions
One-part error chord sounds during startup sequence	<ol style="list-style-type: none"> 1. Disconnect SCSI data cable and hard drive power cable. Reboot system. If startup sequence is normal, run Macintosh Hard Disk Test and replace hard drive, if necessary. 2. Disconnect floppy drive cable connector and reboot system. If startup sequence is normal, replace floppy drive. 3. Replace logic board. Move customer's SIMMs to new logic board.
Two-part error chord sounds during startup sequence	<ol style="list-style-type: none"> 1. Replace DRAM SIMMs. 2. Replace logic board. Move customer's SIMMs to new logic board. 3. Perform a DRAM SIMM verification on replacement logic board.
Miscellaneous Problems	Solutions
No sound from speaker	<ol style="list-style-type: none"> 1. Verify that Volume control panel setting is 1 or above. 2. Check speaker cable. 3. Clean install system software. 4. Clear parameter RAM. Make sure Caps Lock key is up. 5. Replace speaker. 6. Replace logic board. Move customer's SIMMs to new logic board.
Sound from external video source does not record or play through speakers	<ol style="list-style-type: none"> 1. Verify that audio cable connects sound source to sound input port when using S-video. 2. Check speaker cable. 3. Replace speaker. 4. Replace logic board. Move customer's SIMMs to new logic board.
No sound from audio CDs from built-in internal CD-ROM drive.	<ol style="list-style-type: none"> 1. Make sure that <i>Playthrough</i> is selected in Sound control panel.

Troubleshooting Tips – Power Macintosh 6100; WS 6150

When troubleshooting Power Macintosh systems, keep in mind the following:

- If a Power Macintosh system does not power up, you should first attempt to reset the logic board. See “Additional Procedures” for more information.
- With Power Macintosh computers, you must install only noncomposite RAM SIMMs and you must install the RAM SIMMs in like pairs (that is, the same size and speed). You’ll find additional troubleshooting information in the Symptom/Cure charts.
- If a Power Macintosh system has bad RAM SIMMs, a dialog box will alert you to the fact that a bad RAM SIMM has been detected.
- If the system hangs shortly after you install a NuBus card, contact the vendor to verify that the card is compatible with the Power Macintosh system or to see if there is a software upgrade available.
- The Power Macintosh AV systems use the same logic board as the non-AV versions. The only difference is that the AV versions have the Power Macintosh AV Card installed in the PDS slot.
- The Power Macintosh computers use system software version 7.1.2. This version of System 7 runs on all 68040 machines. Although the software has not been tested on 68030 machines, there are no known problems with running the software on there computers.

Symptom/Cure Chart – Quadra 610; Power Macintosh 6100; WS 60, WS 6150

Video Problems	Solutions
Screen is dark, audio and at least one drive operate, fan is running, and LED is lit	<ol style="list-style-type: none">1. Check connections.2. Adjust brightness on monitor.3. Replace video cable.4. Replace monitor.5. Replace VRAM SIMMs. (Quadra 610 only)6. Replace logic board. Move customer's SIMMs to new logic board.
Screen is dark, audio and drive do not operate, fan is running, and LED is lit	<ol style="list-style-type: none">1. Reset logic board. (Power Macintosh only)2. Reseat ROM SIMM and cache SIMM. (Power Macintosh only)3. Remove peripherals.4. Replace VRAM SIMMs. (Quadra 610 only)5. Replace DRAM SIMMs.6. Replace power supply.7. Replace logic board. Move customer's SIMMs to new logic board.
Partial or whole screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none">1. Replace video cable.2. Replace monitor.3. Replace VRAM SIMMs. (Quadra 610 only)4. Replace logic board. Move customer's SIMMs to new logic board.
Screen is completely dark, fan is not running, and LED is not lit	<ol style="list-style-type: none">1. Verify that external power cables are properly connected.2. Remove peripherals.3. Remove NuBus card.4. Replace power supply.5. Replace logic board. Move customer's SIMMs to new logic board.
Floppy Drive Problems	Solutions
Audio and video are present, but internal floppy drive does not operate	<ol style="list-style-type: none">1. Replace internal floppy drive.2. Replace internal floppy drive cable.3. Replace logic board. Move customer's SIMMs to new logic board.
Floppy disk ejects, and display shows Mac icon with blinking "X"	<ol style="list-style-type: none">1. Replace floppy disk.2. Replace floppy drive cable.3. Replace internal floppy drive.4. Replace logic board. Move customer's SIMMs to new logic board.

- | | |
|---|---|
| Floppy disk does not eject | <ol style="list-style-type: none"> 1. Switch off system and hold mouse button down while switching on the system. 2. Eject disk manually. 3. Replace floppy drive cable. 4. Replace floppy drive. |
| Floppy drive attempts to eject disk but doesn't | <ol style="list-style-type: none"> 1. Push floppy disk completely in. 2. Eject floppy disk manually. 3. Replace floppy drive. 4. Reseat or replace top cover assembly. |

Hard Drive Problems

Solutions

- | | |
|---|--|
| Internal hard drive runs continuously, never appears on desktop | <ol style="list-style-type: none"> 1. Update driver software of hard drive using HD SC format. 2. Reinstall clean system software. 3. Replace SCSI data cable. 4. Replace hard drive. 5. Replace logic board. Move customer's SIMMs to new logic board. |
| Internal hard drive does not operate | <ol style="list-style-type: none"> 1. Replace SCSI data cable. 2. Replace SCSI power cable. 3. Replace hard drive. 4. Replace logic board. Move customer's SIMMs to new logic board. |

CD-ROM Drive Problems

Solution

- | | |
|--|---|
| CD-ROM drive does not accept a compact disc | <ol style="list-style-type: none"> 1. Reinstall CD software. 2. Verify that CD-ROM extension is in System Folder. 3. Exchange disc (if disc is dirty or damaged). 4. Replace CD-ROM drive mechanism. 5. Replace 50-pin ribbon cable. (Quadra 610 only) 6. Replace SCSI data cable. (Power Macintosh only) |
| Macintosh does not display CD-ROM drive icon | <ol style="list-style-type: none"> 1. Verify that CD-ROM extension is in System Folder. 2. Reinstall CD software. 3. Replace CD-ROM drive mechanism. 4. Replace power supply. 5. Replace SCSI data cable. (Power Macintosh only) |
| Compact disc won't eject from the drive | <ol style="list-style-type: none"> 1. Turn off file sharing in Sharing Setup control panel. (Power Macintosh only) 2. Manually eject the compact disc. 3. Press the eject button behind the front bezel (if it is accessible). 4. Replace CD-ROM mechanism. |

Peripheral Problems	Solutions
Works with internal or external SCSI device, but does not work with both	<ol style="list-style-type: none"> 1. Verify external cables are to Apple specifications. 2. Verify that each SCSI device is set to a unique SCSI ID number. 3. Verify that hard drive is terminated but optional CD-ROM drive is not terminated. 4. Replace terminator on external hard drive. 5. Replace SCSI select cable on external SCSI device. 6. Replace logic board. Move customer's SIMMs to new logic board.
Cursor does not move	<ol style="list-style-type: none"> 1. Reboot computer with Extensions off by holding down Shift key during startup. 2. Verify that mouse is connected properly. 3. Try different keyboard or ADB cable. 4. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse. 5. Replace logic board. Move customer's SIMMs to new logic board.
Cursor moves, but clicking the mouse button has no effect	<ol style="list-style-type: none"> 1. Replace mouse. 2. Replace logic board. Move customer's SIMMs to new logic board. 3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard.
Double-click does not open application, disk, or server	<ol style="list-style-type: none"> 1. Remove duplicate system files from hard drive. 2. Clear parameter RAM. Make sure Caps Lock key is up. 3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
No response to any key on the keyboard	<ol style="list-style-type: none"> 1. Verify that keyboard is connected to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Replace logic board. Move customer's SIMMs to new logic board.

Power Supply Problems	Solutions
System does not power up (Power Macintosh only)	<ol style="list-style-type: none">1. Reset logic board. (See Additional Procedures.)2. Reseat ROM SIMM and cache SIMM.3. Replace power supply.4. Replace logic board.
Miscellaneous Problems	Solutions
"About This Macintosh" reports more or less memory than is installed (Power Macintosh only)	<ol style="list-style-type: none">1. Verify that RAM SIMMs are installed in matching pairs (same size and speed).2. Replace RAM SIMMs.
System Problems	Solutions
System intermittently crashes or hangs (Power Macintosh only)	<ol style="list-style-type: none">1. Reboot computer with Extension off by holding down Shift key during startup.2. Verify that system software is version 7.1.2 or later.3. Verify that only noncomposite SIMMs are installed, that they are in matching pairs (same size and speed), and that the SIMMs are known-good.4. Verify that software is known-good.5. Verify that software is Power Macintosh compatible.6. Clear parameter RAM. Make sure Caps Lock key is up.7. Replace SIMMs.8. Replace logic board. Move customer's SIMMs to new logic board.9. Replace power supply.

Additional Procedures

The internal expansion slot supports either a processor-direct card or a 7-inch NuBus card (with appropriate adapter) so you can customize your system with extra networking capability such as Ethernet or multiple displays.

Expansion Card Installation

1. Remove the top cover and the expansion port cover (Figure 2-A) from the back panel. On the Power Macintosh 6100/60 and WS 6150 you must also remove the SCSI hard drive cable. (The Power Macintosh 6100/60AV has an AV card installed in the PDS slot. You cannot install additional expansion cards in this machine.)
2. Loosely connect the expansion card connector to the adapter card connector (Figure 2-B).
3. Fit the adapter card pin into the expansion card hole (Figure 2-C).
4. Gently press the expansion card and adapter card connectors together.
5. Insert the connector on the bottom of the adapter card into the expansion slot. Make sure that the tab on the side of the adapter card slides into the slot on the side of the bottom case (Figure 2-D).
6. Attach the thumbscrews (Figure 2-E). On the Power Macintosh 6100/60, you must also reconnect the SCSI hard drive cable, making sure to run the cable over the expansion card.

CPU Replacement – Quadra 610, WS 60

1. Remove the top cover, power supply, expansion card, and logic board.
2. Position the teeth of the PGA processor chip removal tool in the groove between the chip and the socket. Gently lift up the handle to loosen each side of the processor chip from the socket. Remove the processor chip.
3. Position the marked corner of the new processor chip over the marked corner of the processor socket. Carefully align the pins of the processor chip with the corresponding holes in the socket. Press down firmly on each edge of the processor chip. (Refer to “Installation Procedures” in Chapter 2, General Information.)

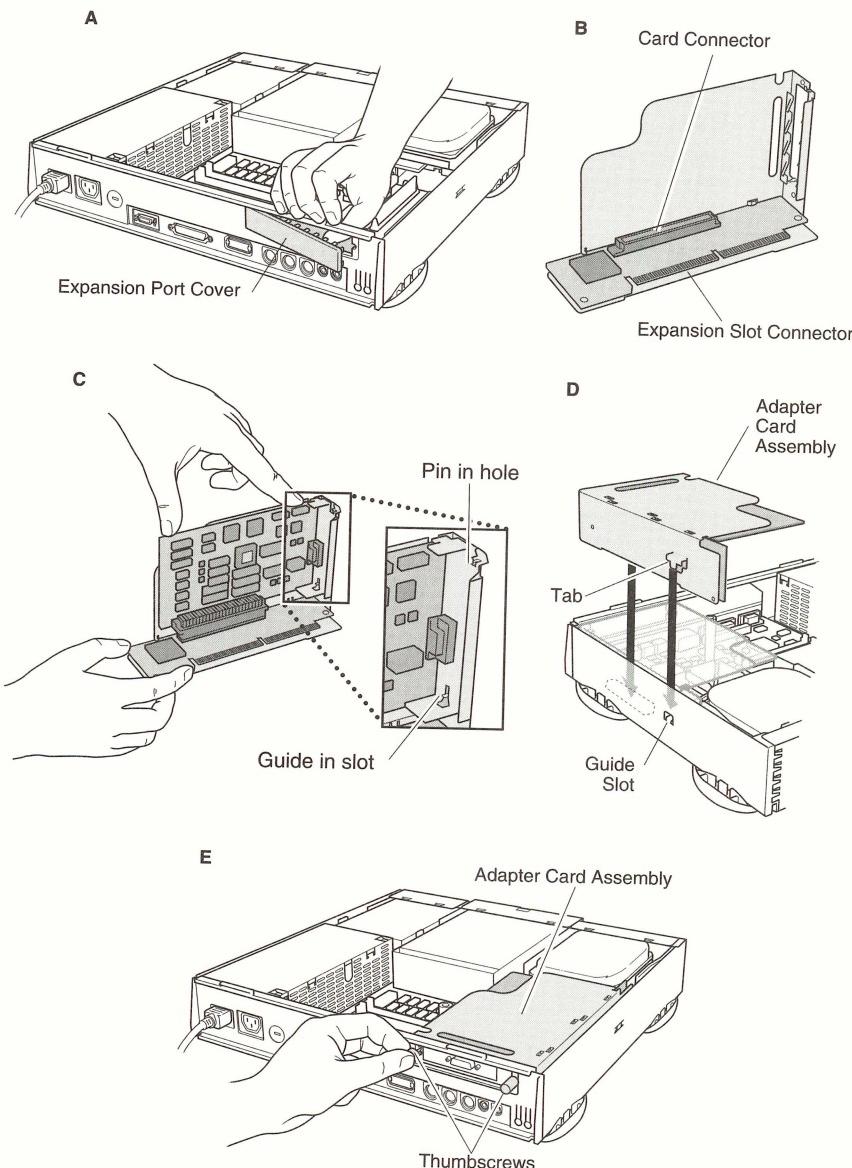


Figure 2 Expansion Card Installation

Reset Logic Board – Power Macintosh 6100

Whenever you have a unit that fails to power up, you should follow this procedure to reset the logic board BEFORE replacing any modules. If this procedure resolves the problem, claim an adjustment on an SRO. If not, replace the defective component and DO NOT claim an adjustment.

This procedure resets PRAM. Be sure to check the computer's time, date, and other system parameter settings after you perform the procedure.

1. Remove the top cover and power cord.
- ▲ Warning** **If handled or discarded improperly, the lithium battery in the computer could explode. Review “Battery and AC Adapter Verification” in Chapter 2, General Information.**
2. Using a small flat-blade screwdriver, pry open the latch at the end of the battery holder and lift off the cover.
 3. Grasp the battery and remove it from the holder.
 4. Press the power-on button. Disconnect the power supply cable from the logic board. Wait 5-10 minutes and replace the battery (make sure the battery faces the correct direction).
 5. Replace the power supply cable, and reassemble the computer.

Upgrades

CD-ROM Drive Upgrade

1. Remove the top cover.
2. Remove the CD-ROM drive bezel from the top cover. Install the new CD-ROM drive bezel in the top cover.
3. Pry off the metal 5.25" drive bay shield from the chassis (Figure 3-A).
4. Attach the CD-ROM drive carrier to the CD-ROM drive with four Phillips screws (Figure 3-B).
5. Push in the CD-ROM drive and carrier, align the slots at the lower edge of the CD-ROM shield with the tabs on the bottom cover, and attach the CD-ROM EMI shield securely onto the bottom cover (Figure 3-C).
6. Connect these cables from the power supply to the CD-ROM drive:
 - CD-ROM audio cable
 - SCSI data cable
 - CD-ROM drive power cable (Figure 3-D)
7. Connect the end of the CD-ROM audio cable to the logic board.

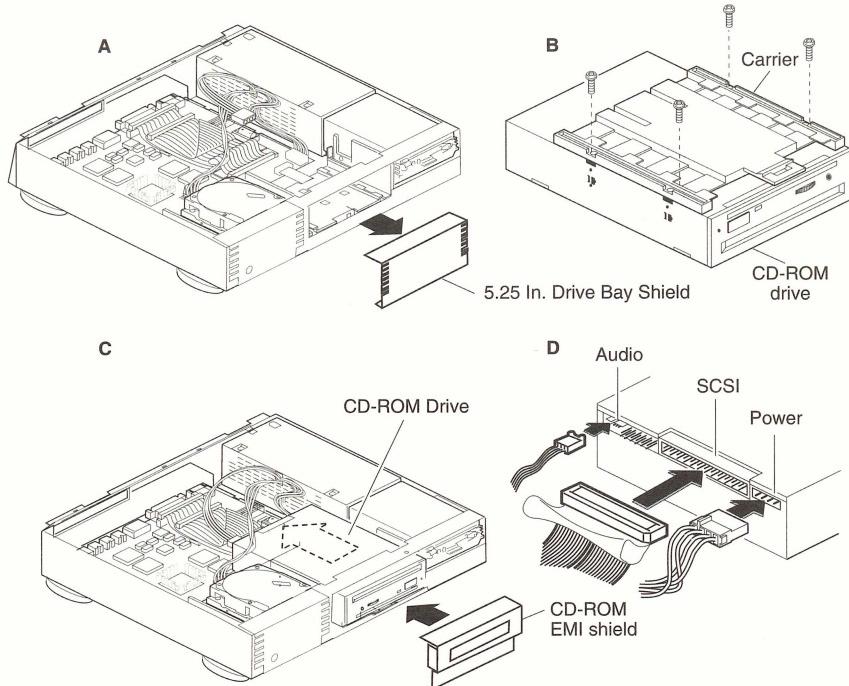


Figure 3 CD-ROM Drive Upgrade

Quadra 610 to 660AV Upgrade

1. Remove the top cover and the power supply.
2. Remove the screw from the center of the standoff, and remove the standoff.
3. Disconnect these cables from the 610 logic board:
 - SCSI data cable
 - Speaker cable
 - LED cable
 - CD-ROM audio cable (if present)
 - Floppy drive cable
4. Lift the front edge of the logic board to make removing the floppy drive easier.
5. Slide forward the hard drive and CD-ROM drive (if installed); slide the logic board toward the front of the computer and remove the board.
6. Using a screwdriver, release the tabs on the upper-rear edge of the bottom cover and push out the 610 I/O panel.
7. Position the 660AV I/O panel in the bottom cover and press the I/O panel to snap the tabs in place.
8. Place the 660AV logic board in the bottom cover just forward of the I/O panel and slide the logic board into place.
9. Connect these cables to the back edge of the logic board:
 - Video-out cable
 - Video-in cable
 - SCSI data cable
10. Connect these cables to the front edge of the 660AV logic board:
 - Floppy drive cable
 - Speaker cable
 - LED cable
 - CD-ROM audio cable (if present)
11. Replace the standoff with the internal Phillips screw.
12. Replace the Phillips screw on the front edge of the logic board.

Quadra 610/660AV to Power Macintosh 6100/60 or 6100/60AV Upgrade

A Power Macintosh 6100/60 Upgrade Kit upgrades a Macintosh Quadra 610 or Macintosh Quadra 660AV machine. The upgrade kit includes a Power Macintosh 6100/60 logic board, insulator sheet I/O panel, rubber foot, SCSI cable, floppy drive EMI shield, CD gasket, and PowerPC sticker. The Power Macintosh 6100/60AV upgrade also includes the Power Macintosh AV Card.

1. Remove the top cover, power supply, and logic board.
2. Press the tabs at the back end of the floppy drive outward and slide the floppy drive forward a few inches.
3. Place the metal openings that are on the side of the EMI shield over the screws that are on either side of the floppy drive. The top of the EMI shield should rest on the floppy drive. Leave the floppy drive pushed out until you replace the power supply later in this procedure.
4. Press up on the tab that is underneath the CD-ROM drive and slide out the CD-ROM drive.
5. Remove the adhesive strip from the EMI gasket (provided in the upgrade kit). Place the rubber gasket on the underneath side of the frame that houses the CD-ROM drive. The gasket should be placed in the middle of the opening for the CD-ROM drive.
6. Replace the CD-ROM drive, but don't push it all the way in until you replace the logic board later in this procedure.
7. Using a flat-blade screwdriver, press down and release the four tabs that secure the back panel to the chassis. Remove the back panel.
8. Remove the existing insulator sheet and replace it with the insulator sheet provided with the upgrade kit.
9. Line up the bottom tabs on the back panel with the slots in the chassis. Press in on the back panel until the top tabs snap into place.
10. Affix the blank serial number label that came with the upgrade kit onto the new back panel. Copy the serial number from the old back panel to the new back panel.
11. Connect the floppy drive cable and insert the PowerPC logic board. Replace the Phillips screw at the front edge of the logic board.
12. Replace the standoff on the logic board and tighten the screw in the center of the standoff.
13. If the customer's original logic board had PowerPC compatible DRAM SIMMs installed, remove them and install them on the upgraded logic board. Return all VRAM and non-matching DRAM SIMMs from the old logic board to the customer.
14. Replace the SCSI data cable with the one provided in the upgrade kit.

-
15. Connect the following cables to the logic board:
 - Speaker cable
 - LED cable
 - CD-ROM audio cable (if present)
 - SCSI data cable
 16. Reconnect these power supply cables:
 - Main power cable
 - Hard drive power cable
 - CD-ROM drive power cable (if installed)
 17. Replace the power supply. Tighten the screw that secures the power supply to the chassis. Push in the CD-ROM drive until you hear it click into place.
 18. Lift up on the top of the metal EMI shield and slide the floppy drive back into place. The top of the metal EMI shield should rest on top of the chassis frame.
 19. **Power Macintosh 6100/60AV only:** Install the Power Macintosh AV Card in the expansion slot on the logic board. Refer to Expansion Card Installation earlier in this chapter for instructions.
 20. Replace the top cover and turn the unit over. Remove the adhesive strip from the rubber foot provided in the upgrade kit. Press the rubber foot onto the bottom chassis towards the back of the unit and directly in front of the screw that secures the logic board to the chassis.
 21. Adhere the 6100/60 sticker to the front of the unit, directly over the current model name.
 22. Install system software version 7.1.2, which comes with the Power Macintosh Logic Board Upgrade Kit. Refer to the user manual provided in the upgrade kit for installation instructions.
 23. Run MacTest Pro in looping mode or other software in demo mode for 1 hour as a burn-in test.
 24. Contact Finished Goods for an RMA number to return the old logic board.

Macintosh Cards

Power Macintosh AV Card

The Power Macintosh 6100/60AV system uses the Power Macintosh AV Card (Figure 4). The Power Macintosh 6100/60AV must have the AV card installed in its PDS slot. Two adapters for composite (RCA-type) video connectors come with the AV system. To connect a cable with RCA plugs, connect the RCA plug to one of the adapters, and connect the adapter to the appropriate S-video port (input or output) on the back of your computer.

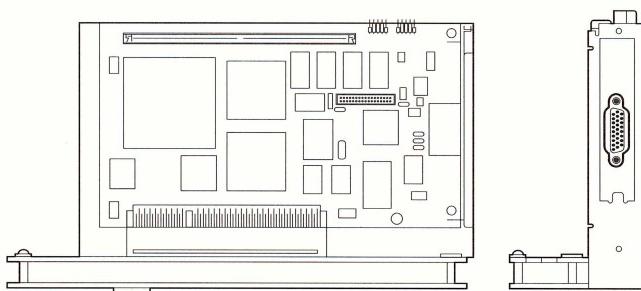


Figure 4 Power Macintosh AV Card

DOS Compatibility Card

The Macintosh DOS Compatibility Card (Figure 5) is designed for the Macintosh Quadra 610 computer to make the system DOS and Windows compatible. The 7-inch DOS Compatibility Card is installed in the PDS slot with an adapter card.

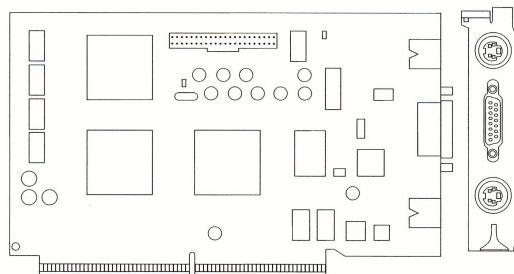


Figure 5 DOS Compatibility Card

Logic Board Diagrams

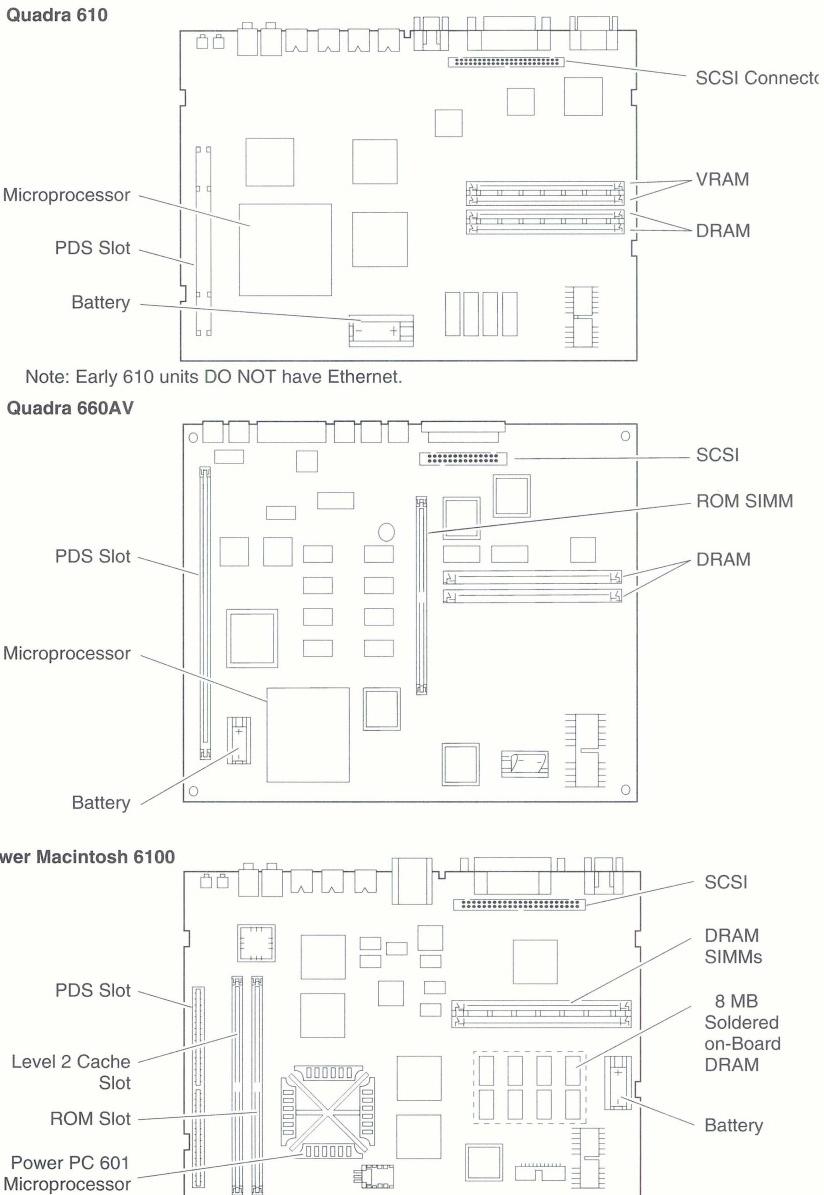
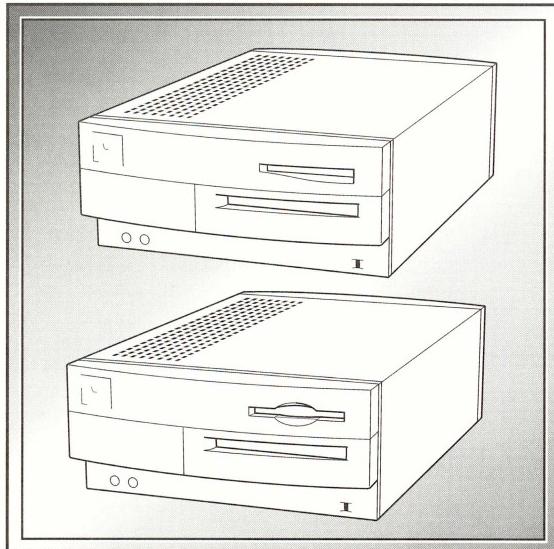


Figure 6 Logic Boards

Macintosh Quadra 650

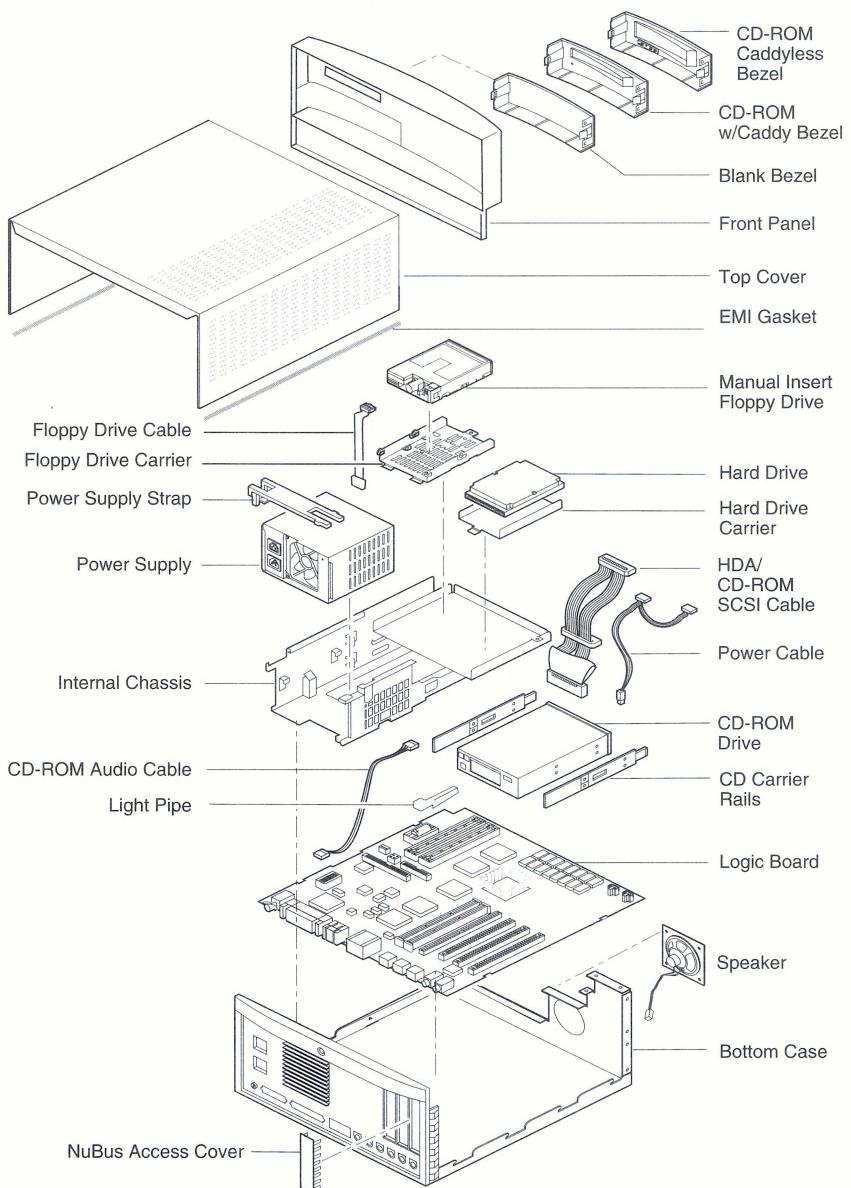
Power Macintosh 7100

10



Illustrated Parts List	174
Specifications – Quadra 650	178
Specifications – Power Macintosh 7100	179
Symptom/Cure Chart – Quadra 650	181
Troubleshooting Tips – Power Macintosh 7100	185
Symptom/Cure Chart – Power Macintosh 7100	186
Reset Logic Board – Power Macintosh 7100	191
Upgrades	192
Power Macintosh Cards	195
Logic Board Diagrams	196

Illustrated Parts List – Quadra 650; Power Macintosh 7100



This is a generic representation of a product family. Configurations may vary.

Figure 1 Exploded View

Note On November 8, 1993, the Centris name was discontinued from the Macintosh product line. The Centris 650 was replaced by the similar, but faster Macintosh Quadra 650.

Bottom Case

Bottom Housing.....	922-0406
Bottom Housing (Power Macintosh).....	922-0898
EMI Bottom Case Clip.....	922-0101
Foot, Platinum	865-0024
Hook, Snap-In, PCB	922-0097
NuBus Cap.....	810-6035

Floppy Drive and Drive Mount Chassis

Apple SuperDrive, 1.4 MB Drive Mechanism	661-0474
Apple SuperDrive, Manual Insert Drive (Power Macintosh)	661-0121
Cable, Floppy Drive.....	922-0112
Carrier, 800K/Apple SuperDrive.....	805-5050
Carrier, 1.4 MB, Floppy, Manual Insert (Power Macintosh)	922-0763
Front Panel, Manual Insert Floppy	922-0542
Housing Assembly, Internal Chassis.....	922-0058
Screw, M3 x 0.5 x 6 (Quadra 650)	460-3400

Hard Drive and CD-ROM Drive

Cable Assembly, HDA/CD-ROM	922-0051
Cable, CD Audio.....	922-0052
Cable, CD Audio (Power Macintosh).....	922-0724
Cable, HDA/CD-ROM, SCSI	922-0053
Cable, CD-ROM, Audio, Mini-T,v1	922-0842
CD Caddy.....	678-5059
Drive Carrier, HDA	922-0066
Drive Mechanism, CD300 (Quadra 650)	661-0023
Drive Mech, Trayloading, CD 300+	661-0222
HDA, 80 MB, 3.5" SCSI.....	661-0111
HDA, 80 MB, 3.5" SCSI.....	661-0774
HDA, 160 MB, 1" High, 3.5" SCSI	661-1647
HDA, 230 MB, 3.5" SCSI.....	661-1637
HDA, 250 MB, 3.5" SCSI (Power Macintosh).....	661-0890
HDA, 500 MB, 3.5" SCSI.....	661-0781
HDA, 500 MB, 3.5" SCSI (Power Macintosh).....	661-0891
Rails, CD Carrier (Pkg. of 5).....	922-0067
Screw, 6-32 x .250	444-6104
Screw, Torx, External Drive.....	416-1305

Logic Board

Battery, Lithium (without leads)	742-0011
Cover, Battery Holder.....	520-0344

Light Pipe, Power On	815-6272
Logic Board, 25 MHz, 4 MB (Quadra 650).....	661-1675
Logic Board, 25 MHz, 4 MB, FPU (Quadra 650).....	661-1679
Logic Board, 25 MHz, 4 MB, Ethernet, FPU.....	661-1677
Logic Board, 25 MHz , 8 MB, Ethernet, FPU.....	661-1678
Logic Board, 33 MHz, 4 MB (Quadra 650).....	661-0011
Logic Board, 33 MHz, 8 MB (Quadra 650).....	661-0044
Logic Board (Power Macintosh)	661-0897
Logic Board Reset Procedure (Power Macintosh)	011-0115
PDS, Power Macintosh AV Card.....	661-1023
Reset/Interrupt Switch.....	815-6270
SIMM, 4 MB, 80 ns, 72-Pin (Power Macintosh)	661-0808
SIMM, 8 MB, 80 ns, 72-Pin	661-0809
SIMM, 16 MB, 80 ns, 72-Pin (Power Macintosh)	661-0087
SIMM, DRAM, 4 MB, 60 ns, 72-Pin (Quadra 650)	661-1701
SIMM, DRAM, 8 MB, 60 ns, 72-Pin (Quadra 650)	661-1702
SIMM, VRAM, 256K, 80 ns, 68-Pin	661-0722
SIMM, 256K Cache (Power Macintosh)	661-1024
Video Card, 2 MB (Power Macintosh).....	661-1748
Top Cover	
Bezel, AppleCD 300	922-0404
Bezel, Apple CD 300, Slotted.....	922-0061
Bezel, CD, Trayloading, Pkg. of 5 (Power Macintosh)	922-0800
Blank CD Bezel	922-0060
Front Panel.....	922-0059
Front Panel (Power Macintosh).....	922-0899
Gasket, Top Cover, Bag of 10 (Power Macintosh).....	922-0887
Housing, Top Cover Assembly (Power Macintosh)	922-0405
Label, Product ID, Pkg. of 10 (Centris 650).....	922-2028
Label, Product ID (Quadra 650)	922-0568
Label, Product ID, Pkg. of 10 (Power Macintosh)	922-0863
Name Plate, Pkg. of 10 (Power Macintosh 7100/66)	922-0801
Name Plate, Pkg. of 10 (Power Macintosh 7100/66AV).....	922-0802
Miscellaneous	
Cable, DIN7 S-Video to Comp Video In (Power Macintosh) ...	922-0816
Cable, DIN7 S-Video to Comp Video Out (Power Macintosh)	922-0817
Cable, HDI-45 to DB-15 (Power Macintosh)	922-0721
Clip, EMI, CD-ROM (Pkg. of 25)	922-0115
Clip, EMI (Pkg. of 10)	922-0101
Facilitation Warranty Reimbursement	011-0083
Hook, Snap In, PCB	922-0097
Microphone Assembly (Quadra 650).....	699-5103
Mouse, Apple Desktop Bus II	661-0763

Mouse Ball (21.9 mm Diameter), Black.....	699-8038
Mouse Ball (22.23 mm Diameter), Gray.....	922-0349
PlainTalk Microphone (Power Macintosh).....	922-0867
Power Cable, AC, 110 V, Smoke	590-0380
Power Supply, 112 Watt.....	661-0758
Retainer, ADB Mouse II, Black for 21.9 mm mouse ball	922-0350
Retainer, ADB Mouse II, Gray for 21.9 mm mouse ball	922-0349
Retainer, ADB Mouse II, Gray for 22.23 mm mouse ball	922-0345
Screw, 3.5 x 1.47 x 30.....	922-0018
Screw, M3.5 x 0.6 x 10 mm (Pkg. of 10)	922-0119
Screw, M3.5 x 0.6 x 20 mm (Pkg. of 10)	922-0116
Screw, M3.5 x 0.6 x 6 mm (Pkg. of 10)	922-0120
Screw, M3.5 x 1.57 x 7 mm (Pkg. of 10)	922-0117
Screw, M3.5 x 1.57 x 30 mm (Pkg. of 10)	922-0118
Speaker Assembly	922-0055
Strap, Power Supply (Bag of 5).....	922-0906
Telecom Adapter (Power Macintosh).....	661-1703

Specifications – Quadra 650

Processor	Centris 650: Motorola 68040; 25 MHz, built-in memory management unit (MMU) and floating-point unit (FPU) Quadra 650: Motorola 68040; 33 MHz, built-in MMU Addressing: 32-bit internal registers, address and data bus
Memory	RAM: 4 MB RAM, expandable to 132 MB; 72-pin SIMM ROM: 1 MB PRAM: 256 bytes VRAM: 512K, expandable to 1 MB Clock/Calendar: Custom chip with long-life lithium battery
Disk Storage	Floppy Drive: 1.4 Apple SuperDrive Hard Drive: 80-500 MB CD-ROM Drive: Optional 5.25-in. CD-ROM drive
I/O Interfaces	ADB: Two ADB ports; mini DIN-4 connectors Serial: Two RS-232/RS-422 ports; mini DIN-8 connectors SCSI: One port; DB-25 connector Expansion Slot: One in-line processor-direct slot Sound: One sound output port (stereo for CDs); one monoaural input port Video: One DB-15 video port for built-in video; VGA and SVGA monitors require a special adapter cable Ethernet: Optional on-board Ethernet port
I/O Devices	Keyboard: Standard or extended keyboard, draws 25-80 mA Mouse: ADB Mouse II Microphone: Optional electret omnidirectional microphone, 4 mV peak-to-peak output voltage at normal speaking Maximum power draw for all ADB devices: 500 mA
Sound and Video	Sound: Custom digital Apple sound chip (ASC); monoaural sound input port; supports VGA monitors (640 x 480) and SVGA monitors (800 x 600) with appropriate adapter cable
Electrical	Line Voltage: 100-240 VAC Frequency: 50-60 Hz Input Power: 325 W Output Power: 112 W
Physical	Height: 6.0 in. (152 mm) Width: 13.0 in. (330 mm) Depth: 16.5 in. (419 mm) Weight: 25 lb. (11.3 kg)

Specifications – Power Macintosh 7100

Processor	66 MHz PowerPC 601 RISC microprocessor, built-in MMU and FPU; requires system software version 7.1.2 or later
Memory	RAM: 8 MB, expandable to 136 MB via 4 SIMM sockets on logic board (80 ns or faster 72-pin SIMMs via pairs of same size); 16 MB configuration has two 4 MB SIMMs installed Cache: 32K of on-chip cache; optional 256K level 2 cache available ROM: 4 MB VRAM: 1 MB, expandable to 2 MB using four 256K VRAM SIMMs (7100/66); 2 MB (7100/66AV) Clock/Calendar: Custom chip with long-life lithium battery
Disk Storage	Floppy Drive: 1.4 MB, manual insert Hard Drive: 250 or 500 MB (7100/66); 500 MB (7100/66AV) CD-ROM Drive: Internal AppleCD 300i+ (optional on 7100/66; standard on 7100/66AV)
I/O Interfaces	ADB: One ADB port; mini DIN-4 connector; maximum power draw 500 mA Serial: Two RS-232/RS-422 LocalTalk/GeoPort serial ports; mini DIN-9 connectors SCSI: One port; DB-25 connector Expansion Slot: One processor-direct slot (PDS); 182-pin connector NuBus: Three NuBus slots support standard size cards; 96-pin Euro-DIN connectors Sound: One 16-bit stereo output port; one 16-bit stereo input port Video: One DRAM-based HDI-45 video port for direct connection to Apple AudioVision monitors (7100/66); one DRAM-based HDI-45 video port for direct connection to Apple AudioVision monitors and VRAM-based S-video input and S-video output ports (7100/66AV) Ethernet: One built-in AAUI-15 Ethernet port
I/O Devices	Keyboard: Standard or extended keyboard, draws 25-80 mA Mouse: ADB Mouse II, draws up to 10 mA Microphone: Apple PlainTalk microphone; unidirectional and optimized for use with speech recognition (optional on 7100/66; standard on 7100/66AV)

Video Display	System must have the Power Macintosh 2 MB Video Card or Power Macintosh AV Card installed; both the 7100/66 and 7100/66AV support monochrome, color, VGA, and SVGA formats on the HDI-45 logic board connector, including Macintosh 12" Monochrome Display (640 x 480), Macintosh 12" RGB Display (512 x 384), AppleColor High-Res RGB 14" Monitor (640 x 480), Apple AudioVision 14 Display (640 x 480), Macintosh Color Display (640 x 480), Macintosh 15" Portrait Display (640 x 870), and Macintosh 16" Color Display (832 x 624); both the 7100/66 and 7100/66AV support the following monitors through via the DB-15 connector on their video cards: Macintosh 19" Color Display (1024 x 768), Apple Multiple Scan 20 Display (1280 x 1024), and Macintosh 21" Color Display (1152 x 870); and the 7100/66AV supports the following monitors via the DB-15 connector on the Power Macintosh AV Card: NTSC (512 x 384 and 640 x 480) and PAL (640 x 480 and 768 x 576)
Electrical	Line Voltage: 100-240 VAC Frequency: 50-60 Hz Input Power: 325 W Output Power: 112 W
Physical	Height: 6.0 in. (152 mm) Width: 13.0 in. (330 mm) Depth: 16.5 in. (419 mm) Weight: 24 lb. (11.3 kg)

Symptom/Cure Chart – Quadra 650

Video Problems	Solutions
Screen is dark, audio and at least one drive operate, fan is running, and LED is lit	<ol style="list-style-type: none"> 1. Adjust brightness on monitor. 2. Check video cable connection. 3. Replace monitor. 4. Replace video cable. 5. Replace VRAM SIMMs. 6. Replace logic board. Move customer's SIMMs to new logic board.
Screen is dark, audio and drive do not operate, fan is running and LED is lit	<ol style="list-style-type: none"> 1. Remove peripherals. 2. Remove NuBus cards. 3. Replace VRAM SIMMs. 4. Replace DRAM SIMMs. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply.
Partial or whole screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none"> 1. Check video cable connection. 2. Replace monitor. 3. Replace video cable. 4. Replace VRAM SIMMs. 5. Replace logic board. Move customer's SIMMs to new logic board.
Screen is completely dark, fan is not running, and LED is not lit	<ol style="list-style-type: none"> 1. Verify that external power cables are properly connected. 2. Remove peripherals. 3. Remove NuBus cards. 4. Check battery on logic board for 3.6 VDC. 5. Replace logic board. Move customer's SIMMs to new logic board. 6. Replace power supply.
Floppy Drive Problems	Solutions
Audio and video are present, but internal floppy drive doesn't operate	<ol style="list-style-type: none"> 1. Perform a clean installation of system software. 2. Replace internal floppy drive cable. 3. Replace internal floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Floppy disk ejects, and display shows Mac icon with blinking "X"	<ol style="list-style-type: none"> 1. Perform a clean installation of system software. 2. Replace floppy disk. 3. Replace floppy drive cable. 4. Replace internal floppy drive. 5. Replace logic board. Move customer's SIMMs to new logic board.

Floppy disk does not eject

1. Switch off system and hold mouse button down while switching on the system.
2. Eject disk manually.
3. Replace floppy drive cable.
4. Replace floppy drive.
5. Replace logic board. Move customer's SIMMs to new logic board.

Floppy drive attempts to eject disk but doesn't

1. Push floppy disk completely in.
2. Eject floppy disk manually.
3. Replace floppy drive cable.
4. Replace floppy drive.

Hard Drive Problems

Solutions

Internal hard drive runs continuously

1. Perform a clean installation of system software.
2. Replace SCSI data cable.
3. Replace internal hard drive.
4. Replace logic board. Move customer's SIMMs to new logic board.

Internal hard drive does not operate

1. Remove external SCSI devices.
2. Replace SCSI data cable.
3. Replace SCSI power cable.
4. Replace hard drive.
5. Replace logic board. Move customer's SIMMs to new logic board.

CD-ROM Drive Problems

Solution

CD-ROM drive does not accept compact disc

1. Exchange disc (if disc is dirty or damaged).
2. Replace CD-ROM drive mechanism.

Macintosh does not display CD-ROM drive icon

1. Reinstall CD-ROM Setup.
2. Perform a clean installation of system software.
3. Verify that CD-ROM extension is in System Folder.
4. Replace CD-ROM drive mechanism.
5. Replace power supply.
6. Replace SCSI data cable.

Peripheral Problems

Solutions

Works with internal or external SCSI device, but does not work with both

1. Verify that each SCSI device is set to a unique SCSI ID number.
2. Verify that hard drive is terminated but optional CD-ROM drive is not terminated.
3. Replace terminator on external hard drive.
4. Replace SCSI select cable on external SCSI device.

Cursor does not move	1. Reboot computer. 2. Verify that mouse is connected properly. 3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse. 4. Perform a clean installation of system software. 5. Replace logic board. Move customer's SIMMs to new logic board.
Cursor moves, but clicking the mouse button has no effect	1. Boot from Disk Tools; if no failure, check system software. 2. Replace mouse. 3. Replace logic board. Move customer's SIMMs to new logic board.
Double-click does not open application, disk, or server	1. Remove duplicate system files from hard drive. 2. Clear parameter RAM. Make sure Caps Lock key is up. 3. Perform a clean installation of system software. 4. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse. 5. Replace logic board. Move customer's SIMMs to new logic board.
No response to any key on the keyboard	1. Boot from Disk Tools; if no failure, check system software. 2. Verify that keyboard is connected to ADB port. 3. Replace keyboard cable. 4. Replace keyboard. 5. Replace logic board. Move customer's SIMMs to new logic board.

Error Chords**Solutions**

One-part error chord sounds during startup sequence	1. Disconnect hard drive power cable and hard drive data cable. Reboot system. If system startup sequence is normal, run Macintosh Hard Disk test and replace hard drive if necessary. 2. Disconnect floppy drive cable and reboot system. If startup sequence is normal, replace floppy drive. 3. Replace logic board. Move customer's SIMMs to new logic board.
---	---

System Problems	Solutions
Two-part error chord sounds during startup sequence	<ol style="list-style-type: none"> 1. Boot off Disk Tools, if no failure, check system software. 2. Replace SIMMs. 3. Replace logic board. Move customer's SIMMs to new logic board. 4. Perform SIMM verification on replacement logic board.
Does not power on; screen is black, fan is not running, and LED is not lit	<ol style="list-style-type: none"> 1. Check cables. 2. Plug monitor directly into wall socket and verify that monitor has power. 3. Replace power cord. 4. Check battery on logic board for 3.6 VDC. 5. Replace power supply. 6. Replace logic board. Move customer's SIMMs to new logic board.
Power supply clicks or chirps	<ol style="list-style-type: none"> 1. Replace power supply. 2. Replace logic board. Move customer's SIMMs to new logic board.
System shuts down intermittently	<ol style="list-style-type: none"> 1. Check that air vents are clear. Thermal protection circuitry may shut down system. After 35 to 40 minutes, system should be OK. 2. Replace power cord. 3. Check batteries. (See General Information chapter.) 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
System intermittently crashes or locks up	<ol style="list-style-type: none"> 1. Verify that system software is correct version. 2. Verify that software is known-good. 3. Boot from Disk Tools; if no failure, check system software. 4. Reboot computer with Extensions off by holding down Shift key during startup. 5. Replace SIMMs. 6. Replace power supply. 7. Replace logic board. Move customer's SIMMs to new logic board.

Troubleshooting Tips – Power Macintosh 7100

1
0

When troubleshooting Power Macintosh systems, keep in mind the following:

- If a Power Macintosh system does not power up, you should first attempt to reset the logic board. See “Reset Logic Board” for more information.
- With Power Macintosh computers, you must install only noncomposite RAM SIMMs and the RAM SIMMs must be installed in like pairs (that is, the same size and speed).
- If a Power Macintosh system has bad RAM SIMMs, a dialog box will alert you to the fact that a bad RAM SIMM has been detected.
- If the system hangs shortly after installing a NuBus card, contact the vendor to verify that the card is compatible with the Power Macintosh system or to see if there is a software upgrade available.
- The Power Macintosh 7100/66 MUST have a video card installed in the PDS slot. The Power Macintosh 7100/66 system uses the Power Macintosh 2 MB Video Card. A missing card can result in a system that won’t boot up or a system that crashes.
- The Power Macintosh 7100/66AV MUST have the Power Macintosh AV Card installed in its PDS slot. All Power Macintosh AV systems use the same logic board as their non-AV versions. The only difference is that the AV versions have the Power Macintosh AV Card installed in the PDS slot.
- The Power Macintosh computers use system software version 7.1.2 or later. This version of System 7 runs on all 68040 machines. Although the software has not been tested on 68030 machines, there are no known problems with running the software on 68030 computers.

Symptom/Cure Chart – Power Macintosh 7100

Video Problems	Solutions
Screen is dark, audio and at least one drive operate, fan is running, and LED is lit	<ol style="list-style-type: none">1. Adjust brightness on monitor.2. Check video cable connection.3. Replace video cable.4. Try using known-good RAM SIMMs.5. If monitor is attached to DB-15 connector, attach monitor to HDI-45 connector. If problem goes away, verify VRAM SIMMs on video card are good. If SIMMs are bad, replace them. If SIMMs are good, replace video card.6. Replace monitor.7. Replace logic board. Move customer's SIMMs to new logic board.
Screen is dark, audio and drive do not operate, fan is running, and LED is lit	<ol style="list-style-type: none">1. Check video cable connection.2. Remove peripherals.3. Remove NuBus cards.4. Replace DRAM SIMMs.5. Replace VRAM SIMMs.6. Replace video card.7. Replace logic board. Move customer's SIMMs to new logic board.8. Replace power supply.
Partial or whole screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none">1. Check video cable connection.2. Replace video cable.3. Replace VRAM SIMMs.4. Replace video card.5. Replace monitor.6. Replace logic board. Move customer's SIMMs to new logic board.
Screen is completely dark, fan is not running, and LED is not lit	<ol style="list-style-type: none">1. Verify that external power cables are properly connected.2. Reset logic board. (See "Reset Logic Board.")3. Remove peripherals.4. Remove NuBus cards.5. Check battery for 3.6 VDC.6. Replace power supply.7. Replace logic board. Move customer's SIMMs to new logic board.

Floppy Drive Problems	Solutions
Audio and video are present, but internal floppy drive does not operate	<ol style="list-style-type: none">1. Boot from Disk Tools; if no failure, check system software.2. Replace internal floppy drive cable.3. Replace internal floppy drive.4. Replace logic board. Move customer's SIMMs to new logic board.
Floppy disk ejects, and display shows Mac icon with blinking "X"	<ol style="list-style-type: none">1. Try a different floppy disk.2. Boot from Disk Tools; if no failure, check system software.3. Replace floppy drive cable.4. Replace internal floppy drive.5. Replace logic board. Move customer's SIMMs to new logic board.
Floppy disk does not eject	<ol style="list-style-type: none">1. Reboot computer with Extensions off by holding down Shift key during startup.2. Switch off system and hold mouse button down while switching on the system.3. Eject disk manually.4. Replace floppy drive cable.5. Replace floppy drive.
Floppy drive attempts to eject disk but doesn't	<ol style="list-style-type: none">1. Push floppy disk completely in.2. Eject floppy disk manually.3. Replace floppy drive cable.4. Replace floppy drive.
Hard Drive Problems	Solutions
Internal hard drive runs continuously	<ol style="list-style-type: none">1. Update driver software of hard drive using HD SC Setup.2. Reinstall system software.3. Replace SCSI data cable.4. Replace internal hard drive.5. Replace logic board. Move customer's SIMMs to new logic board.
Internal hard drive does not operate	<ol style="list-style-type: none">1. Reboot computer with Extensions off by holding down Shift key during startup.2. Replace SCSI data cable.3. Replace SCSI power cable.4. Replace hard drive.5. Replace logic board. Move customer's SIMMs to new logic board.

CD-ROM Drive Problems	Solution
CD-ROM drive does not accept compact disc	<ol style="list-style-type: none"> 1. Exchange disc (if disc is dirty or damaged). 2. Replace CD-ROM drive mechanism.
Macintosh does not display CD-ROM drive icon	<ol style="list-style-type: none"> 1. Reinstall CD-ROM driver. 2. Clean install of system software. 3. Verify that CD-ROM extension is in System Folder. 4. Replace CD-ROM drive mechanism. 5. Replace SCSI data cable.
Compact disc won't eject	<ol style="list-style-type: none"> 1. Turn off file sharing in Sharing Setup control panel. 2. Manually eject the compact disc. 3. Press the eject button behind the front bezel (if it is accessible). 4. Replace CD-ROM drive mechanism.
Peripheral Problems	Solutions
Works with internal or external SCSI device, but does not work with both	<ol style="list-style-type: none"> 1. Verify that each SCSI device is set to a unique SCSI ID number. 2. Verify that hard drive is terminated but optional CD-ROM drive is not terminated. 3. Replace terminator on external hard drive. 4. Replace SCSI select cable on external SCSI device. 5. Replace logic board. Move customer's SIMMs to new logic board.
Cursor does not move	<ol style="list-style-type: none"> 1. Reboot computer with Extensions off by holding down Shift key during startup. 2. Verify that mouse is connected properly. 3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
Cursor moves, but clicking the mouse button has no effect	<ol style="list-style-type: none"> 1. Replace mouse. 2. Replace logic board. Move customer's SIMMs to new logic board. 3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard.

- | | |
|---|--|
| Double-click does not open application, disk, or server | <ol style="list-style-type: none">1. Remove duplicate system files from hard drive.2. Clear parameter RAM. Make sure Caps Lock key is up.3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse.4. Replace logic board. Move customer's SIMMs to new logic board. |
| No response to any key on the keyboard | <ol style="list-style-type: none">1. Verify that keyboard is connected to ADB port.2. Replace keyboard cable.3. Replace keyboard.4. Replace logic board. Move customer's SIMMs to new logic board. |

System Problems**Solutions**

- | | |
|--|---|
| Does not power on; screen is black, fan is not running, and LED is not lit | <ol style="list-style-type: none">1. Check cables.2. Plug monitor directly into wall socket and verify that monitor has power.3. Reset logic board. (See "Reset Logic Board.")4. Reseat ROM SIMM and cache SIMM.5. Replace power cord.6. Check battery 3.6 VDC.7. Replace power supply.8. Replace logic board. Move customer's SIMMs to new logic board. |
| Power supply clicks or chirps | <ol style="list-style-type: none">1. Replace power supply.2. Replace logic board. Move customer's SIMMs to new logic board. |
| System shuts down intermittently | <ol style="list-style-type: none">1. Check that air vents are clear. Thermal protection circuitry may shut down system. After 35 to 40 minutes, system should be OK.2. Replace power cord.3. Check battery 3.6 VDC.4. Replace power supply.5. Replace logic board. Move customer's SIMMs to new logic board. |

<p>System intermittently crashes or locks up</p>	<ol style="list-style-type: none"> 1. Verify system software is version 7.1.2 or later. 2. Verify SIMMs are noncomposite and installed in like pairs (same size and speed). 3. Verify that software is known-good. 4. Verify that software is Power Macintosh compatible (contact developer). 5. Verify that a video card is installed in the PDS slot. 6. Clear parameter RAM. Make sure Caps Lock key is up. 7. Replace SIMMs. 8. Replace logic board. Move customer's SIMMs to new logic board. 9. Replace power supply.
<p>Error Chords</p>	<p>Solutions</p>
<p>One-part error chord sounds during startup sequence</p>	<ol style="list-style-type: none"> 1. Disconnect hard drive power cable and hard drive data cable. Reboot system. Run Macintosh Hard Disk test and replace hard drive if necessary. 2. Disconnect floppy drive cable and reboot system. If startup sequence is normal, replace floppy drive. 3. Replace logic board. Move customer's SIMMs to new logic board.
<p>Power Supply Problems</p>	<p>Solutions</p>
<p>System does not power up</p>	<ol style="list-style-type: none"> 1. Reset logic board (See "Reset Logic Board.") 2. Reseat ROM SIMM and cache SIMM. 3. Check battery on logic board for 3.6 VDC. 4. Replace power supply. 5. Replace logic board.
<p>Miscellaneous Problems</p>	<p>Solutions</p>
<p>About This Macintosh reports more or less memory than is installed</p>	<ol style="list-style-type: none"> 1. Verify that RAM SIMMs are noncomposite and installed in like pairs (same size and speed). 2. Replace RAM SIMMs.

Reset Logic Board – Power Macintosh 7100

Whenever you have a Power Macintosh that fails to power up, you should follow this procedure to reset the logic board BEFORE replacing any modules. If this procedure resolves the problem, claim an adjustment on an SRO. If not, replace the defective component and DO NOT claim an adjustment.

This procedure resets PRAM. Be sure to check the computer's time, date, and other system parameter settings after you perform the procedure.

1. Remove the top cover, power supply, drive chassis, and power cord.

▲ Warning

If handled or discarded improperly, the lithium battery in the computer could explode. Review “Battery and AC Adapter Verification” in Chapter 2, General Information.

2. Using a small flat-blade screwdriver, pry open the latch at the end of the battery holder and lift off the cover.
3. Grasp the battery and remove it from the holder.
4. Press the power-on button. Wait 5-10 minutes and replace the battery (make sure the battery faces the correct direction), the drive chassis, and the power supply.

Upgrades

CD-ROM Drive Upgrade

1. Remove the top cover.
2. From the inside of the top cover, squeeze in the tabs of the blank bezel and push out the bezel (Figure 2-A).
3. Push in the slotted CD-ROM bezel (Figure 2-B).
4. Install the EMI shield on the front of the CD-ROM drive (Power Macintosh 7100/66 and 7100/66AV only).
5. Attach the CD-ROM drive rails to the CD-ROM drive. Slide the CD-ROM drive about three quarters of the way into the drive mount chassis (Figure 2-C).
6. Connect these cables to the CD-ROM drive (Figure 2-D):
 - CD-ROM audio cable
 - SCSI data cable
 - SCSI power cable
7. Connect the CD-ROM audio cable to the logic board.
8. Push the CD-ROM drive completely into the CD-ROM slot until you hear a click.

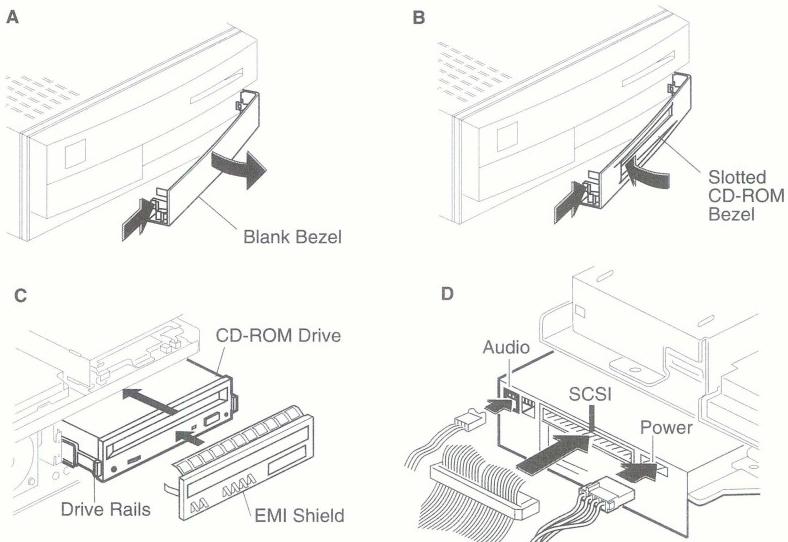


Figure 2 CD-ROM Drive Upgrade

Quadra 650 to Power Macintosh 7100/66 or 7100/66AV Upgrade

A Power Macintosh 7100/66 Upgrade Kit upgrades a Macintosh Quadra 650 to a Power Macintosh 7100/66 or 7100/66AV.

1. Remove the top cover, power supply, CD-ROM drive (if present), and hard drive.
2. Disconnect the following cables from the old logic board and reconnect them to the upgraded logic board:
 - CD-ROM audio cable (if present)
 - Floppy drive cable
 - SCSI data cable

Note

You may find it easier to connect the cables if you remove the drive chassis. The new SCSI power cable is already connected to the upgraded logic board.

3. If the customer's original logic board has DRAM SIMMs that are compatible with the Power Macintosh 7100/66, remove them and install them on the upgraded logic board. Return all VRAM and non-matching DRAM SIMMs from the old logic board to the customer.
4. Guide the mounting tabs on the hard drive carrier into the slots in the upgraded drive chassis. Slide the hard drive carrier into place.
5. Insert the mounting screw that secures the hard drive carrier to the drive chassis.
6. Install the EMI shield on the front of the CD-ROM drive (if present). Slide the CD-ROM drive into the upgraded drive chassis.
7. Connect these cables to the CD-ROM device (if present):
 - SCSI power cable
 - SCSI data cable
 - CD-ROM audio cable
8. Connect these cables to the floppy and hard drives:
 - Floppy drive cable
 - SCSI power cable
 - SCSI data cable
9. Reinstall the power supply in the drive chassis. Press down on the power supply until it snaps into place. Replace the power supply screw at the rear bezel. An extra power supply screw is provided in the upgrade kit.

-
- 10. If there was a power supply strap installed on the old unit, squeeze on the two ends of the strap and push it through the metal opening on the upgraded unit to install it. (The power supply strap is part of the shipping packaging for some power supplies. When replacing the power supply you should replace the strap, if present.)

Note

The height of the power supply will determine whether you install the power supply strap in the top or bottom slot. When installed, the strap should be flush with the power supply.

- 11. The Power Macintosh 7100/66 and 7100/66AV MUST have a video card installed for proper bus termination. To upgrade to a Power Macintosh 7100/66 machine, install the Power Macintosh 2 MB Video Card in the PDS slot on the logic board. To upgrade to a Power Macintosh 7100/66AV machine, install the Power Macintosh AV Card.
- 12. Remove the reset/interrupt switch from the old chassis and install it in the upgraded chassis.
- 13. Connect the speaker cable to the upgraded logic board.
- 14. Copy the computer's serial number from the old top cover to the new top cover. A blank serial number label is provided on the back of the upgraded bottom housing.
- 15. Lower the top cover down so that it clears the drives and slide the top cover back into place. Do not attempt to tilt the top cover when you install it. Do not jar the reset/interrupt switch and light pipe out of alignment when you replace the cover.
- 16. Carefully tighten the captive screw on the top cover. Be aware that excessive force on the captive screw will damage the top cover.
- 17. Install the system software 7.1.2 that came with the Power Macintosh Logic Board Upgrade Kit. Refer to the user manual provided in the upgrade kit for installation instructions.
- 18. Run MacTest Pro in looping mode or other software in demo mode for 1 hour as a burn-in test.
- 19. Contact Finished Goods for an RMA number to return the old logic board. Return the old logic board and floppy drive in the old housing.

Power Macintosh Cards

Power Macintosh 2 MB Video Card

The Power Macintosh 7100/66 system uses the Power Macintosh 2 MB Video Card (Figure 3). The 2 MB Video Card comes with 1 MB of VRAM and is expandable to 2 MB by using four 256K VRAM SIMMs. The Power Macintosh 7100/66 must have a video card installed in the PDS slot. The card must remain installed to properly terminate the PDS bus. A missing card can result in a system that won't boot or a system that crashes.

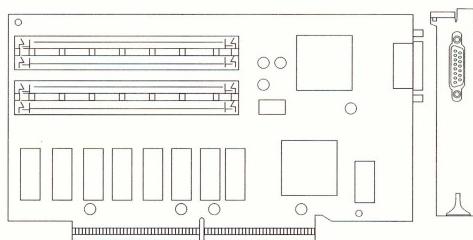


Figure 3 Power Macintosh 2 MB Video Card

Power Macintosh AV Card

The Power Macintosh 7100/66AV system uses the Power Macintosh AV Card (Figure 4). The Power Macintosh 7100/66AV must have the AV card installed in its PDS slot. Two adapters for composite (RCA-type) video connectors come with the AV system. To connect a cable with RCA plugs, connect the RCA plug to one of the adapters, and connect the adapter to the appropriate S-video port (input or output) on the back of your computer.

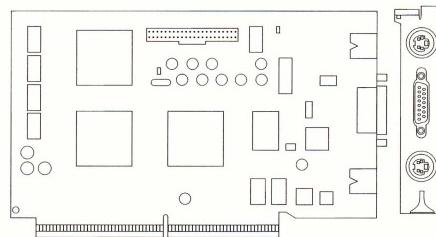
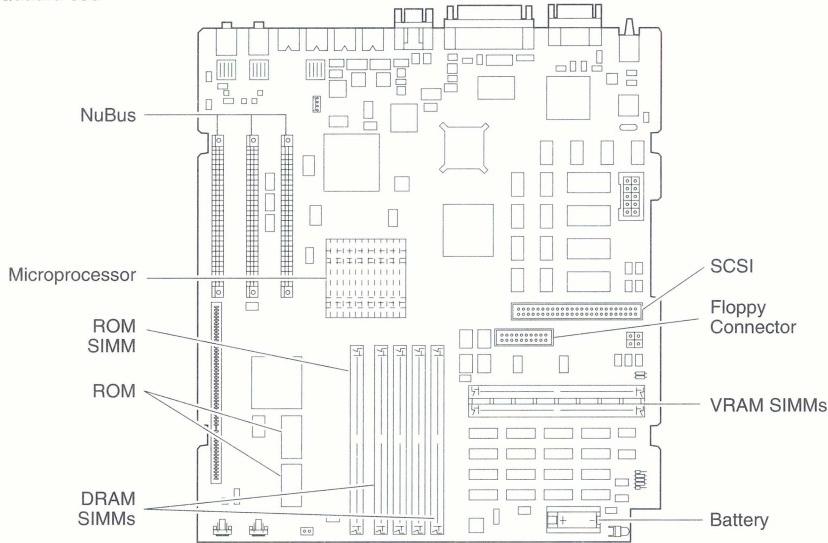


Figure 4 Power Macintosh AV Card

Logic Board Diagrams

Qudra 650



Power Macintosh 7100

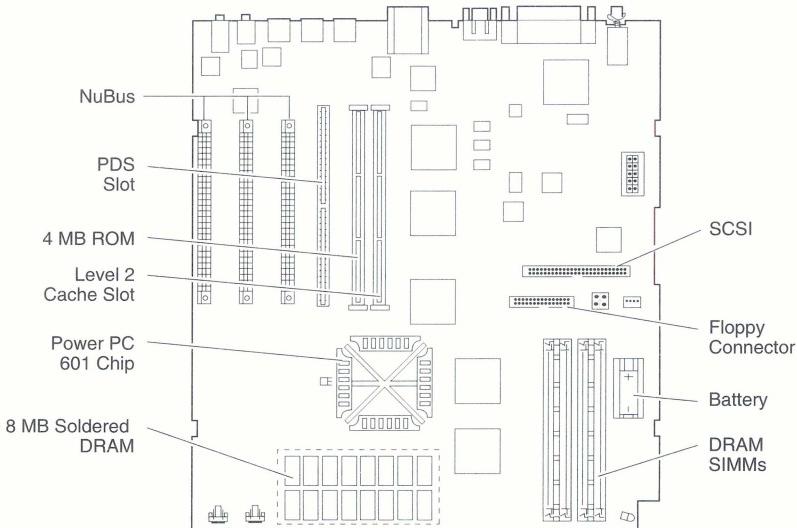
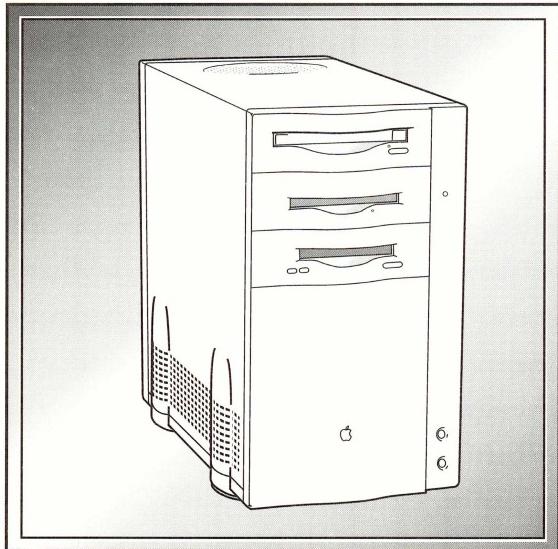


Figure 5 Logic Boards

Macintosh Quadra 800, 840AV

Power Macintosh 8100

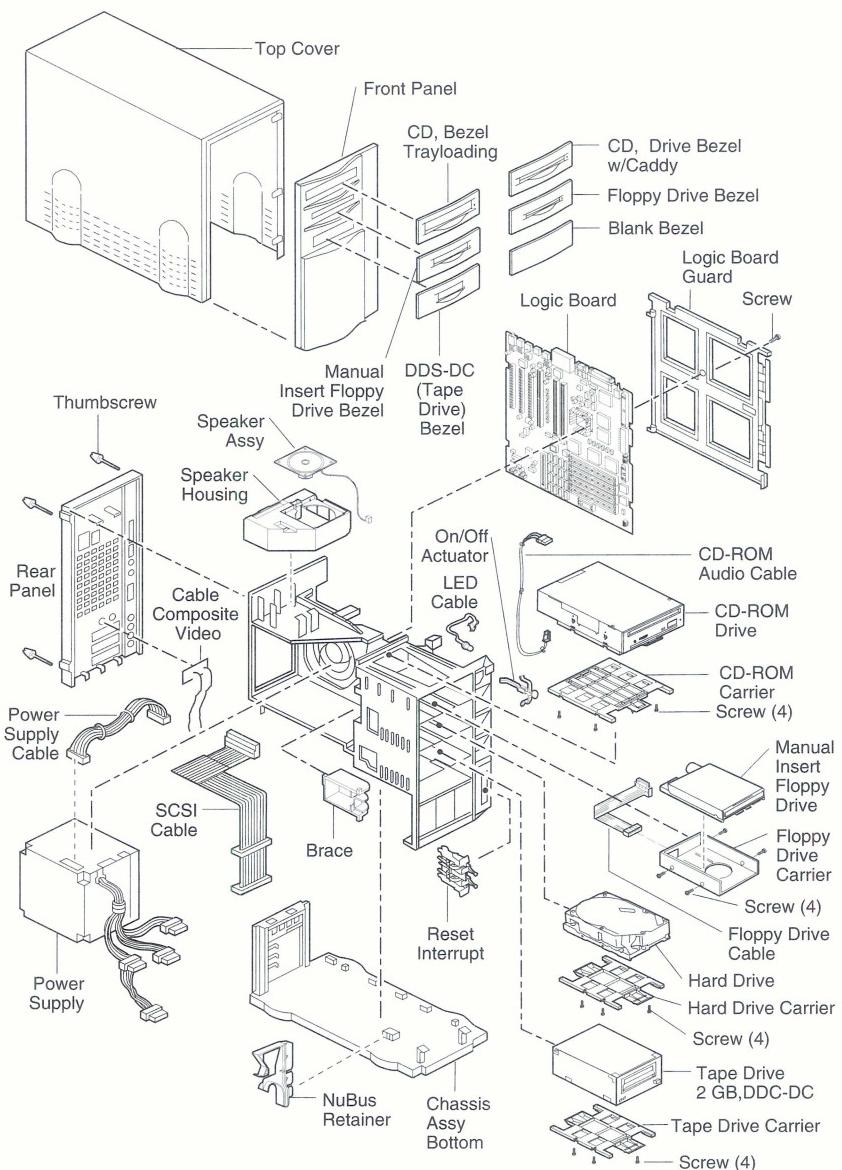
WS 80, WS 8150



1
1

Illustrated Parts List	198
Specifications – Quadra 800, 840AV; WS 80	202
Specifications – Power Macintosh 8100; WS 8150	204
Symptom/Cure Chart – Quadra 800, 840AV; WS 80	206
Troubleshooting Tips – Power Macintosh 8100; WS 8150	212
Symptom/Cure Chart – Power Macintosh 8100; WS 8150	213
Reset Logic Board – Power Macintosh 8100; WS 8150	218
Upgrades	219
Power Macintosh Cards	221
Logic Board Diagrams	222

Illustrated Parts List – Quadra 800, 840AV; Power Macintosh 8100; WS 80, WS 8150



This is a generic representation of a product family. Configurations may vary.

Figure 1 Exploded View

CD-ROM Drive	
Cable, CD Audio, Mini-T, v1 (Quadra 800)	922-0842
Cable, CD Audio, Mini-T, v2 (Quadra 840AV).....	922-0873
Cable, CD Audio (Power Macintosh 8100; WS 8150).....	922-0724
Cable, CD/DAT, SCSI (Power Macintosh)	922-0723
Carrier, CD-ROM Drive	922-0850
CD 300 Plus Drive w/o Headphones (Power Macintosh).....	661-0222
Drive Mechanism w/o Headphone board, CD 300	661-0023
Screw, CD-ROM Carrier.....	922-0401
Chassis Assembly	
Brace, Chassis Support, Mini-T.....	922-0396
Cable, LED, Mini-T	922-0841
Cable, SCSI Drive, Mini-T, v1 (Quadra 800)	922-0839
Cable, SCSI Drive, Mini-T, v2 (Quadra 840AV)	922-0871
Cable, HDA, SCSI (Power Macintosh)	922-0803
Cable, Composite Video (Quadra 840AV)	922-0870
Chassis, Internal/Bottom, Mini-T	922-0844
Chassis, Internal/Bottom, (Power Macintosh)	922-0888
On/Off Actuator, Mini-T, v2 (Quadra 840AV)	922-2030
Rear Housing Assembly (Power Macintosh).....	922-0722
Rear Panel (Quadra 800)	922-0362
Rear Panel (Quadra 840AV)	922-2027
Reset/interrupt, Mini-T, v1 (Quadra 800, Power Macintosh) ...	922-0843
Retainer, NuBus, Mini-T	922-0393
Thumbscrew Slotted, 6-32, Mini-T (Pkg. of 4).....	922-0395
DAT Drive	
Carrier, Hard Drive and DDS-DC, 3.5" (Quadra 800).....	922-0621
Screw, CD-Carrier (Quadra 800).....	922-0401
Tape Drive, 2 GB DDS-DC SCSI (Quadra 800).....	661-0795
Tape Drive, DAT, DDS-2, 120 M (WS 8150).....	661-0039
Floppy Drive	
Apple SuperDrive, 1.4 MB Drive Mechanism	661-0474
Apple SuperDrive, Manual Insert Drive	661-0121
Cable, Floppy Drive, Mini-T, v1 (Quadra 800).....	922-0840
Cable, Drive, Mini-T, v2 (Quadra 840AV, Power Macintosh) .	922-0872
Carrier, SuperDrive	922-1807
Carrier, Manual Insert Drive	922-0445
Screw, M 3 x 1.57 x 7 MM (Pkg. of 10)	922-0117
Shield, Floppy Drive, Pkg. of 5 (WS 8150).....	922-0813
Shield, SuperDrive, Long	922-0399
Logic Board	
Battery, Lithium	742-0011
Cover, Battery Holder.....	520-0344

Guard, Logic Board, Mini-T (Qty. of 5)	922-0851
Logic Board, 33 MHz, 8 MB, E-net (Quadra 800)	661-1676
Logic Board, 40 MHz (Quadra 840AV).....	661-1700
Logic Board (Power Macintosh)	661-1026
Logic Board Reset (Power Macintosh).....	011-0115
PDS, Power Macintosh AV Card.....	661-1023
PDS Terminator Board (WS 8150).....	922-0967
Power Macintosh Upgrade Card (040 PDS)	661-0035
Screw, M 3.5 x 0.6 x 10 MM (Pkg. of 10)	922-0119
SIMM, DRAM, 16 MB, 80 ns, 72-pin (Power Macintosh)	661-0087
SIMM, DRAM, 4 MB, 60 ns, 72-pin	661-1701
SIMM, DRAM, 4 MB, 80 ns, 72-pin (Power Macintosh)	661-0808
SIMM, DRAM, 8 MB, 60 ns, 72-pin	661-1702
SIMM, DRAM, 8 MB, 80 ns, 72-pin (Power Macintosh)	661-0809
SIMM, VRAM, 256K, 80 ns, 68-pin	661-0722
SIMM, VRAM, 512K, 80 ns, 68-pin (Power Macintosh)	661-0893
SIMM, 256K Cache (Power Macintosh)	661-1024
Video Card, 4 MB (Power Macintosh)	661-1027
Power Supply	
Cable, Power Supply to Logic Board (Quadra 800)	922-0837
Cable, Power Supply to Logic Board (Power Macintosh).....	922-0838
Power Supply, 200 Watt.....	661-1687
SCSI Hard Drives	
Carrier, Hard Drive and DDS-DC, 3.5"	922-0621
HDA, 2 GB, 3.5" SCSI (WS 8150).....	661-0892
HDA, 1 GB, 3.5" SCSI	661-0780
HDA, 1 GB, 3.5" SCSI (WS 8150).....	661-0065
HDA, 230 MB, 3.5" SCSI.....	661-1637
HDA, 250 MB, 3.5" SCSI, Unhoused	661-0890
HDA, 500 MB, 3.5" SCSI.....	661-0781
HDA, 500 MB, 3.5" SCSI, Unhoused	661-0891
Screw, Sems 6-32 x .313 PN CRS.....	440-6105
Speaker Assembly	
Speaker Assembly (Quadra 800, Power Macintosh)	922-0353
Speaker Assembly (Quadra 840AV)	922-0055
Speaker Housing, Mini-T	922-0394
Top Cover	
Bezel, Blank, Mini-T, v1 (Quadra 800)	922-0845
Bezel, Blank, Mini-T, v2	922-0620
Bezel, CD, Trayloading, Pkg. of 5 (Power Macintosh)	922-0811
Bezel, CD Drive, Mini-T.....	922-0846
Bezel, DAT Drive, Bag of 5 (WS 8150)	922-0969
Bezel, DDS-DC, Mini-T, v2 (Quadra 800)	922-0619

Bezel, Front, Manual Insert Drive	922-0523
Bezel, SuperDrive, Mini-T	922-0849
Front Panel (Power Macintosh 8100/80).....	922-0814
Front Panel (Power Macintosh 8100/80AV).....	922-0815
Front Panel (Quadra 800)	922-0363
Front Panel (Quadra 840AV).....	922-2026
Front Panel (WS 80).....	922-0618
Front Panel (WS 8150).....	922-0970
Top Cover, Mini-T.....	922-0847
Miscellaneous	
Apple Extended Keyboard II (Quadra 840AV)	661-0543
Assembly, Accessory Kit, USA (Power Macintosh).....	601-0669
Cable, AC Power Cord, Domestic.....	590-0760
Cable, AC Power Cord, International	590-0094
Cable, AC Power Cord, UK (Quadra 800).....	590-0420
Cable Assembly, British power cord (Quadra 840AV)	590-0091
Cable, DIN7 (S-Video) to Composite Video, Input	922-0816
Cable, DIN7 (S-Video) to Composite Video, Output	922-0817
Cable, HDI-45 to DB-15 (Power Macintosh)	922-0721
Carrier, Hard Drive, 3.5 (Quadra 800)	922-0622
Connector, Jumper (Bag of 10).....	517-0546
Facilitation Warranty Reimbursement	011-0083
Label, Product ID (Power Macintosh).....	922-0830
Label, Product ID (Quadra 800)	922-0397
Label, Product ID (Quadra 840AV)	922-2025
Label, Product ID Europe (Quadra 840AV).....	922-0877
Label, Product ID (WS 80)	922-0622
Label, Product ID (WS 8150)	922-0968
Microphone Assembly (Quadra 800).....	699-5071
Microphone Assembly, Apple PlainTalk (Quadra 840AV).....	922-0649
Microphone, PlainTalk (Power Macintosh).....	922-0867
Mouse Ball (21.9 mm Diameter), Black (Power Macintosh)....	699-0838
Mouse Ball (21.9 mm Diameter), Gray (Power Macintosh)....	922-0349
Mouse, ADB II (Power Macintosh)	661-0763
Retainer, ADB Mouse II (for 21.9 mm Black Ball)	922-0350
Retainer, ADB Mouse II (for 22.23 mm Gray Ball)	922-0345
Screw, M3.5 x 1.57 x 7MM (Pkg. of 10)	922-0117
Shield, CD 300i, Mini-T, v2 (Quadra 840AV)	922-0649
Shield, CD-ROM, Trayloading (Pkg. of 5)	922-0812
Telecom Adapter (Power Macintosh)	661-1703

Specifications – Quadra 800, 840AV; WS 80

Processor	Quadra 800 and WS 80: 33 MHz 68040 microprocessor; built-in paged memory management unit (PMMU), floating-point unit (FPU), and 8K memory cache Quadra 840AV: 40 MHz 68040 microprocessor; integrated PMMU, math coprocessor; 8K memory cache; 66 MHz AT&T 3210 digital signal processor Addressing: 32-bit internal register, address bus, and data bus
Memory	RAM: 8 MB, expandable to 136 MB, (Quadra 840AV expandable to 128 MB) ROM: 1 MB (Quadra 800 and WS 80); 2 MB (Quadra 840AV) PRAM: 256 bytes VRAM: 512K or 1 MB; expandable to 1 MB (Quadra 800), expandable to 2 MB (Quadra 840AV) Clock/Calendar: Custom chip with long-life lithium battery.
Disk Storage	Floppy Drive: 1.4 MB Apple SuperDrive Hard Drive: 230, 500, 1000 MB CD-ROM Drive: Internal CD-300 mechanism (optional) Tape Drive (WS 80): Supports a DDS-DC tape drive (optional)
I/O Interfaces	ADB: Two ADB ports, mini DIN-4 connectors (Quadra 800, WS 80); one ADB port, mini DIN-4 connector (Quadra 840AV) Audio: One 8-bit stereo output port; one 8-bit monoaural input port; mini phone jack connectors (Quadra 800); One 16-bit stereo output port; one 16-bit stereo input port; mini phone jack connectors (Quadra 840AV) Serial: Two RS-232/RS-422 ports; mini DIN-8 connectors SCSI: One port; DB-25 connector Expansion Slot: One 68040 processor-direct slot (PDS); 140-pin connector GeoPort (Quadra 840AV): High-performance serial port, supports connection to analog, PBX, ISDN, facsimile (fax), and data telephone lines Video: One port; DB-15 connector, supports Apple monitors (up to 16-bits), VGA monitors, and NTSC and PAL video standards NuBus: Three NuBus slots support standard size cards; 96-pin Euro-DIN connectors Ethernet: One built-in AAUI-15 Ethernet port
I/O Devices	Keyboard: Apple keyboard, extended keyboard, keyboard II, or extended keyboard II (optional); mini DIN-4 connector Mouse: ADB mouse or ADB mouse II; mini DIN-4 connector Microphone: Optional electret omnidirectional microphone, 4 mV peak-to-peak output voltage at normal value

Sound and Video	Sound: Enhanced Apple sound chip (EASC), including four-voice wavetable synthesis and stereo sampling generator capable of driving stereo mini phone-jack headphones or stereo equipment Video Display: Built-in VRAM video support for all Apple monitors; four VRAM expansion slots (two banks); supports Apple 16-bit monitors and many non-Apple monitor types (NTSC, PAL, VGA); supports multiple external color and monochrome monitors through NuBus expansion slots
Electrical	Line Voltage: 100-240 VAC Frequency: 50-60 Hz Input Power: 200 W
Physical	Height: 14.25 in. (360 mm) Width: 7.75 in. (196 mm) Depth: 16.0 in. (396 mm) Weight: 24.0 lb. (11.3 kg)

Specifications – Power Macintosh 8100; WS 8150

Processor	80 MHz PowerPC 601 RISC microprocessor; built-in MMU and FPU; 32K of on-chip cache memory; requires system software version 7.1.2 or later
Memory	DRAM: 8 MB of RAM; expandable to 264 MB Cache: 32K of on-chip cache; optional 256K level 2 cache SIMM ROM: 4 MB installed in SIMM socket VRAM: 2 MB, expandable to 4 MB (8100/80 and 8150); 2 MB, including support for NTSC or PAL monitors (8100/80AV) Clock/Calendar: Custom chip with long-life lithium battery
Disk Storage	Floppy Drive: 1.4 MB Apple SuperDrive Manual Insert Hard Drive: 500 or 1000 MB (8100/80 and 8150); 500 MB (8100/80AV); Internal DAT drive optional (WS 8150) CD-ROM Drive: Internal AppleCD 300i+ (optional on 8100 and WS 8150; standard on 8100/80AV)
I/O Interfaces	ADB: One ADB port; mini DIN-4 connector; maximum power draw 500 mA Serial: Two RS-232/RS-422 LocalTalk/GeoPort serial ports; mini DIN-9 connectors SCSI: One port; DB-25 connector Expansion Slot: One processor-direct slot (PDS); 182-pin connector NuBus: Three NuBus slots support standard size cards; 96-pin Euro-DIN connectors Sound: 16-bit stereo in and out ports Video (8100): One HDI-45 DRAM-based video port on logic board; DB-15 video connector on 4 MB video card Video (8100/80AV): One HDI-45 DRAM-based video port on logic board; one DB-15 video connector and S-video input and output ports on AV card Video (WS 8150): One HDI-45 DRAM-based video port on logic board Ethernet: One built-in AAUI-15 Ethernet port
I/O Devices	Keyboard: Apple keyboard, extended keyboard, or adjustable keyboard Mouse: ADB Mouse II Microphone: Apple PlainTalk microphone (optional on 8100; standard on 8100/80AV)
Video Display	Support monochrome, color, VGA, and SVGA format on the HDI-45 logic board connector, including: Macintosh 12" Monochrome Display, Macintosh 12" RGB Display, AppleColor High-Res RGB 14" Monitor, Apple AudioVision 14 Display, Macintosh Color Display, Macintosh 15" Portrait Display, Macintosh 16" Color Display 8100/80 & 8100/80AV support the following monitors via a DB-15 connector: Macintosh 19" Color Display, Apple Multiple Scan 20 Display, Macintosh 21" Color Display; and the 8100/80AV supports NTSC and PAL formats via the DB-15 connector on the Power Macintosh AV Card

Electrical	Line Voltage: 100-240 VAC Frequency: 50-60 Hz Input Power: 454 W maximum power, not including monitor Output Power: 200 W maximum
Physical	Height: 14.25 in. (360 mm) Width: 7.75 in. (196 mm) Depth: 16.0 in. (396 mm) Weight: 25.3 lb. (11.5 kg)

Symptom/Cure Chart – Quadra 800, 840AV; WS 80

Video Problems	Solutions
Screen is black, audio and drive operate, fan is running, and LED is lit	<ol style="list-style-type: none">1. Adjust brightness on monitor.2. Try different monitor.3. Replace video cable.4. If video interface card is installed, move it to a different slot.5. Replace video card, if installed.6. Clear parameter RAM. Make sure Caps Lock key is up.7. Replace SIMMs.8. Replace logic board. Move customer's SIMMs to new logic board.9. Replace power supply.
Screen is black, audio and drive do not operate, but fan is running and LED is lit	<ol style="list-style-type: none">1. Replace video cable.2. If video interface card is installed, move it to a different slot.3. Replace video interface card, if installed.4. Replace SIMMs.5. Replace logic board. Move customer's SIMMs to new logic board.6. Replace power supply.
Partial or whole screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none">1. Try different monitor.2. Replace video cable.3. If video interface card is installed, move it to a different slot.4. Replace video interface card, if installed.5. Clear parameter RAM. Make sure Caps Lock key is up.6. Replace logic board. Move customer's SIMMs to new logic board.
Floppy Drive Problems	Solutions
Internal floppy drive does not operate	<ol style="list-style-type: none">1. Replace disk with known-good floppy disk.2. Replace floppy drive cable.3. Replace floppy drive.4. Replace logic board. Move customer's SIMMs to new logic board.5. Replace power supply.

Fails to read 800K disks	<ol style="list-style-type: none">1. Make sure that composite SIMMs (RAM) are not installed. (See composite SIMM information in Chapter 2, General Information.)2. Clear parameter RAM. Make sure Caps Lock key is up.3. Reboot computer with extensions off by holding down Shift key during startup.4. Turn off Sound Play through, Voice Recognition, Apple Express Modem, or any application that may use the DSP chip.
During system startup with a floppy disk, disk ejects; display shows icon with blinking "X"	<ol style="list-style-type: none">1. Replace system disk with known-good disk.2. Clear parameter RAM. Make sure Caps Lock key is up.3. Replace floppy drive cable.4. Replace floppy drive.5. Replace SIMMs.6. Replace logic board. Move customer's SIMMs to new logic board.
Does not eject disk	<ol style="list-style-type: none">1. Switch off computer. Hold mouse button down while you switch computer on.2. Replace floppy drive cable.3. Replace floppy drive.4. Replace logic board. Move customer's SIMMs to new logic board.
Attempts to eject disk, but doesn't	<ol style="list-style-type: none">1. Push disk completely in.2. Reseat floppy drive bezel and drive so bezel aligns correctly with drive.3. Eject disk manually.4. Replace floppy drive.
Internal floppy drive runs continuously	<ol style="list-style-type: none">1. Replace disk with known-good floppy disk.2. Replace floppy drive cable.3. Replace floppy drive.4. Replace logic board. Move customer's SIMMs to new logic board.
Drive does not recognize MS-DOS disks	<ol style="list-style-type: none">1. To read and write MS-DOS files, format all disks with MS-DOS drive first.
Hard Drive Problems	Solutions
Single internal hard drive does not operate; drive doesn't spin	<ol style="list-style-type: none">1. Replace hard drive power cable.2. Replace hard drive.3. Replace power supply.

No internal SCSI devices operate	<ol style="list-style-type: none"> 1. Verify there are no duplicate SCSI device addresses – internal and external. 2. Replace SCSI data cable. 3. Replace power supply. 4. Replace logic board. Move customer's SIMMs to new logic board.
Drive does not appear on the desktop	<ol style="list-style-type: none"> 1. Verify there are no duplicate SCSI device addresses. 2. Clear parameter RAM. Make sure Caps Lock key is up. 3. If drive is not initialized, use HD SC Setup to initialize. 4. Verify termination of internal SCSI bus. Make sure hard drive is attached to SCSI connector. 5. Replace hard drive.
Works with internal or external SCSI device, but does not work with both	<ol style="list-style-type: none"> 1. Verify that each SCSI device is set to a unique SCSI ID number. 2. Verify that hard drive is terminated but optional CD-ROM drive is not terminated. 3. Replace terminator on external hard drive. 4. Replace SCSI select cable on external SCSI device.

CD-ROM Drive Problems Solution

CD-ROM drive does not accept compact disc	<ol style="list-style-type: none"> 1. Exchange disc. 2. Replace CD-ROM drive mechanism.
Macintosh does not display CD-ROM drive icon	<ol style="list-style-type: none"> 1. Verify that proper version of CD-ROM software is installed. 2. Replace CD-ROM drive mechanism. 3. Replace SCSI data cable. 4. Replace power supply.

Peripheral Problems Solutions

No response to any key on the keyboard	<ol style="list-style-type: none"> 1. Verify that keyboard is connected to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Replace logic board. Move customer's SIMMs to new logic board.
--	--

	Solutions
Cursor does not move	<ol style="list-style-type: none">1. Check mouse connection.2. Inspect inside of mouse for buildup of dirt or other contaminants. Clean mouse if necessary.3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse.4. Replace logic board. Move customer's SIMMs to new logic board.
Cursor moves, but clicking the mouse button has no effect	<ol style="list-style-type: none">1. Replace mouse.2. Replace logic board. Move customer's SIMMs to new logic board.
Double-click does not open selected item	<ol style="list-style-type: none">1. Remove duplicate system folders.2. Clear parameter RAM. Make sure Caps Lock key is up.3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse.4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good serial printer does not work	<ol style="list-style-type: none">1. Verify that system software is version 7.1 or later.2. Verify that Chooser is set correctly.3. Verify that printer is known-good.4. Replace printer interface cable.5. Replace logic board. Move customer's SIMMs to new logic board.
Known-good network printer does not print	<ol style="list-style-type: none">1. Verify that system software is version 7.1 or later.2. Verify that Chooser is set correctly.3. Verify that network cabling is good.4. Replace logic board. Move customer's SIMMs to new logic board.

Error Chords

One-part error chord sounds during startup sequence

1. Disconnect SCSI data cable from hard drive and reboot system. If system startup sequence is normal, initialize hard drive. If error chord sounds, again, replace hard drive.
2. Disconnect floppy drive cable from floppy drive and reboot system. If startup sequence is normal, replace floppy drive.
3. Replace logic board. Move customer's SIMMs to new logic board.

<p>Two-part error chord sounds during startup sequence</p> <p>System Problems</p> <p>Does not power on; screen is black, fan is not running, and LED is not lit</p> <p>Power supply clicks or chirps</p> <p>Power supply clicks or chirps (Macintosh Quadra 840AV)</p> <p>System shuts down intermittently</p>	<ol style="list-style-type: none"> 1. Perform SIMM verification. 2. Replace logic board. Move customer's SIMMs to new logic board. <p>Solutions</p> <ol style="list-style-type: none"> 1. Check power cables. 2. Plug monitor directly into wall socket and verify that monitor has power. 3. Replace power cord. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board. <ol style="list-style-type: none"> 1. Replace power supply. 2. Replace logic board. Move customer's SIMMs to new logic board. 3. Replace floppy drive cable. 4. Replace floppy drive. <ol style="list-style-type: none"> 1. Remove all NuBus expansion cards and disconnect all internal peripherals (hard drive, CD-ROM drive, floppy drive, etc.) and power-on system again. If system powers on normally, reconnect one device at a time and replace NuBus expansion cards one at a time, powering on the system after each reconnection/reinstallation. The defective module is identified when the symptom reappears. 2. Replace power supply. 3. Replace logic board. Move customer's SIMMs to new logic board. <ol style="list-style-type: none"> 1. Check that air vents are clear. Thermal protection circuitry may shut down system. After 35 to 40 minutes, system should be OK. 2. Check battery. (See Lithium Battery Verification in Chapter 2, General Information.) 3. Replace power cord. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
---	--

-
- System intermittently crashes or locks up
1. Verify that system software is version 7.1 or later.
 2. Verify that software is known-good.
 3. Verify that software is System 7 compatible.
 4. Clean install of system software.
 5. Clear parameter RAM. Make sure Caps Lock key is up.
 6. Replace SIMMs
 7. Replace logic board. Move customer's SIMMs to new logic board.
 8. Replace power supply.

- During startup, the following message is displayed, "This startup disk will not work on this Macintosh model...."
(Macintosh Quadra 800)
1. Verify that startup disk is good and enabler is installed.
 2. Attach LED cable to logic board.
 3. Replace LED cable.
 4. Replace logic board. Move customer's SIMMs to new logic board.

When troubleshooting Power Macintosh systems, keep in mind the following:

- If a Power Macintosh system does not power up, you should first attempt to reset the logic board.
- With Power Macintosh computers, you must install only noncomposite RAM SIMMs and the RAM SIMMs must be installed in like pairs (that is, the same size and speed). Additional troubleshooting information is provided in the Symptom/Cure charts.
- If a Power Macintosh system has bad RAM SIMMs installed, a dialog box will alert you to the fact that a bad RAM SIMM has been detected.
- If the system hangs shortly after installing a NuBus card, contact the vendor to verify that the card is compatible with the Power Macintosh system or to see if there is a software upgrade available.
- The Power Macintosh AV systems use the same logic board as the non-AV versions. The only difference is that the AV versions have the Power Macintosh AV Card installed in the PDS slot.
- The Power Macintosh 8100/80 systems MUST have a video card installed in the PDS slot. The Power Macintosh 8100/80 system uses the Power Macintosh 4 MB Video Card. The Power Macintosh 8100/80 system uses the Power Macintosh AV Card. A missing card can result in a system that won't boot or a system that crashes.
- The WGS 8150 must have a PDS terminator card or Power Macintosh Video Card installed in its PDS slot.
- The Power Macintosh computers use system software version 7.1.2 or later. This version of System 7 runs on all 68040 machines. Although the software has not been tested on 68030 machines, there are no known problems with running the software on the computers.

Symptom/Cure Chart – Power Macintosh 8100; WS 8150

Video Problems	Solutions
Screen is dark, audio and at least one drive operate, fan is running, and LED is lit	<ol style="list-style-type: none">1. Adjust brightness on monitor.2. Replace video cable.3. Try using known-good RAM SIMMs.4. Replace video card.5. Clear parameter RAM. Make sure Caps Lock key is up.6. Replace SIMMs.7. Try known-good monitor.8. Replace logic board. Move customer's SIMMs to new logic board.9. Replace power supply.
Screen is dark, audio and drive do not operate, fan is running, and LED is lit	<ol style="list-style-type: none">1. Replace video cable.2. Replace video card.3. Replace SIMMs.4. Replace logic board. Move customer's SIMMs to new logic board.5. Replace power supply.
Partial or whole screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none">1. Replace video cable.2. Replace video card.3. Clear parameter RAM. Make sure Caps Lock key is up.4. Try known-good monitor.5. Replace logic board. Move customer's SIMMs to new logic board.
Floppy Drive Problems	Solutions
Internal floppy drive does not operate	<ol style="list-style-type: none">1. Replace disk with known-good floppy disk.2. Replace floppy drive cable.3. Replace floppy drive.4. Replace logic board. Move customer's SIMMs to new logic board.5. Replace power supply.
During system startup, disk ejects; display shows Mac icon with blinking "X"	<ol style="list-style-type: none">1. Replace disk with known-good system disk.2. Clear parameter RAM. Make sure Caps Lock key is up.3. Replace floppy drive cable.4. Replace floppy drive.5. Replace logic board. Move customer's SIMMs to new logic board.

1
1

Does not eject disk	<ol style="list-style-type: none"> 1. Switch off computer. Hold mouse button down while switching computer on. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Attempts to eject disk, but doesn't	<ol style="list-style-type: none"> 1. Push disk completely in. 2. Reseat floppy drive bezel and drive so bezel slot aligns correctly with drive. 3. Eject disk manually. 4. Replace floppy drive.
Internal floppy drive runs continuously	<ol style="list-style-type: none"> 1. Replace disk with known-good floppy disk. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Replace logic board. Move customer's SIMMs to new logic board.
Drive does not recognize MS-DOS disks	<ol style="list-style-type: none"> 1. To read and write MS-DOS files, format all disks with MS-DOS drive first.

Hard Drive Problems

Solutions

Single internal hard drive does not operate; drive doesn't spin	<ol style="list-style-type: none"> 1. Update driver software of hard drive using HD SC Setup. 2. Reinstall system software. 3. Replace hard drive power cable. 4. Replace hard drive. 5. Replace power supply.
No internal SCSI drives operate	<ol style="list-style-type: none"> 1. Verify there are no duplicate SCSI device addresses. 2. Verify SCSI terminator. 3. Replace SCSI data cable. 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
Drive does not appear on the desktop	<ol style="list-style-type: none"> 1. Verify there are no duplicate SCSI device addresses. 2. Verify SCSI terminator. 3. If drive is not initialized, use HD SC setup to initialize it. 4. Replace hard drive.

Works with internal or external SCSI device, but does not work with both	<ol style="list-style-type: none"> Verify that each SCSI device is set to a unique SCSI ID number. Verify that hard drive is terminated but optional CD-ROM drive is not terminated. Replace terminator on external hard drive. Replace SCSI select cable on external SCSI device.
CD-ROM Drive Problems	Solution
CD-ROM drive does not accept compact disc	<ol style="list-style-type: none"> Exchange disc. Replace CD-ROM drive mechanism.
Macintosh does not display CD-ROM drive icon	<ol style="list-style-type: none"> Verify that the correct version of CD-ROM software is installed. Replace CD-ROM drive mechanism. Replace SCSI data cable.
Peripheral Problems	Solutions
Cursor does not move	<ol style="list-style-type: none"> Replace external SCSI cables. Verify that there is only one terminator on external devices. Check mouse connection. Inspect inside of mouse for buildup of dirt or other contaminants. Clean mouse if necessary. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse. Replace logic board. Move customer's SIMMs to new logic board.
Cursor moves, but clicking the mouse button has no effect	<ol style="list-style-type: none"> Replace mouse. Replace logic board. Move customer's SIMMs to new logic board.
Double-click does not open application, disk, or server	<ol style="list-style-type: none"> Remove duplicate system files from hard drive. Clear parameter RAM. Make sure Caps Lock key is up. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse. Replace logic board. Move customer's SIMMs to new logic board.

System Problems	Solutions
No response to any key on the keyboard	<ol style="list-style-type: none"> 1. Check keyboard connection to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good serial printer does not work	<ol style="list-style-type: none"> 1. Verify system software is version 7.1.2 or later. 2. Verify that Chooser is set correctly. 3. Replace printer interface cable. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good network printer does not print	<ol style="list-style-type: none"> 1. Verify system software is version 7.1.2 or later. 2. Verify that Chooser is set correctly. 3. Check printer cabling. 4. Replace logic board. Move customer's SIMMs to new logic board.
Does not power on, screen is black, fan is not running, and LED is not lit	<ol style="list-style-type: none"> 1. Check power cables. 2. Plug monitor directly into wall socket and verify that monitor has power. 3. Reset logic board. (See "Reset Logic Board.") 4. Reseat ROM SIMM and cache SIMM. 5. Replace power cord. 6. Replace power supply. 7. Replace logic board. Move customer's SIMMs to new logic board.
Power supply clicks or chirps	<ol style="list-style-type: none"> 1. Replace power supply. 2. Replace logic board. Move customer's SIMMs to new logic board. 3. Replace floppy drive cable. 4. Replace floppy drive.
System shuts down intermittently	<ol style="list-style-type: none"> 1. Make sure air vents are clear. Thermal protection circuitry may shut down system. After 35 to 40 minutes, system should be OK. 2. Replace power cord. 3. Reset logic board. (See "Reset Logic Board.") 4. Replace power supply. 5. Replace logic board. Move customer's SIMMs to new logic board.
During startup, following message is displayed, "This startup disk will not work on this Macintosh"	<ol style="list-style-type: none"> 1. Verify that startup disk is good. 2. Attach LED cable to logic board. 3. Replace LED cable. 4. Replace logic board. Move customer's SIMMs to new logic board.

System intermittently crashes or locks up	<ol style="list-style-type: none">1. Verify that system software is version 7.1.2 or later.2. Verify SIMMs are noncomposite and installed in matching pairs (same size and speed).3. Verify that software is known-good.4. Verify that software is Power Macintosh compatible (contact developer).5. Verify that a video card is installed in the PDS slot.6. Clear parameter RAM. Make sure Caps Lock key is up.7. Replace SIMMs.8. Replace logic board. Move customer's SIMMs to new logic board.9. Replace power supply.
Power Supply Problems	Solutions
System does not power up	<ol style="list-style-type: none">1. Reset logic board. (See "Reset Logic Board.")2. Reseat ROM SIMM and cache SIMM.3. Replace power supply.4. Replace logic board.
Miscellaneous Problems	Solutions
No sound from speaker	<ol style="list-style-type: none">1. Verify that Volume control panel setting is 1 or above.2. If you are using an audio CD, Make sure "Play through" has been selected in Sound control panel.3. Replace speaker.4. Replace logic board. Move customer's SIMMs to new logic board.
"About This Macintosh" reports more or less memory than is installed	<ol style="list-style-type: none">1. Verify that RAM SIMMs are installed in matching pairs (same size and speed).2. Replace RAM SIMMs.
One-part error chord sounds during startup sequence	<ol style="list-style-type: none">1. Disconnect SCSI data cable from hard drive and reboot system. If startup sequence is normal, initialize hard drive. If error chord still sounds, replace hard drive.2. Disconnect floppy drive cable from floppy drive and reboot system. If startup sequence is normal, replace floppy drive.3. Replace logic board. Move customer's SIMMs to new logic board.

Whenever you have a unit that fails to power up, you should follow this procedure to reset the logic board BEFORE replacing any modules. If this procedure resolves the problem, claim an adjustment on an SRO. If not, replace the defective component and DO NOT claim an adjustment.

This procedure resets PRAM. Be sure to check the computer's time, date, and other system parameter settings after you perform the procedure.

1. Remove the top cover, power cord, and logic board.

▲ Warning

If handled or discarded improperly, the lithium battery in the computer could explode. Review “Battery and AC Adapter Verification” in Chapter 2, General Information.

2. Using a small flat-blade screwdriver, pry open the latch at the end of the battery holder and lift off the cover.
3. Grasp the battery and remove it from the holder.
4. Press the power-on button. Verify that the power supply cable is disconnected from the logic board. Wait 5-10 minutes and replace the battery (make sure the battery faces the correct direction).
5. Reassemble the computer.

Upgrades

1
1

CD-ROM Drive Upgrade

1. Remove the top cover.
2. Remove the upper blank bezel from the top cover.
3. Attach the CD-ROM carrier to the CD-ROM drive with four Phillips screws (Figure 2-A).
4. Verify the two jumper connectors are installed as shown in Figure 2-B.
5. Slide in the CD-ROM drive and carrier (Figure 2-C).
6. Connect these cables to the CD-ROM drive (Figure 2-B):
 - Audio cable
 - SCSI data cable
 - CD-ROM drive power cable
7. Install the slotted CD-ROM drive bezel in the top cover (Figure 2-D).

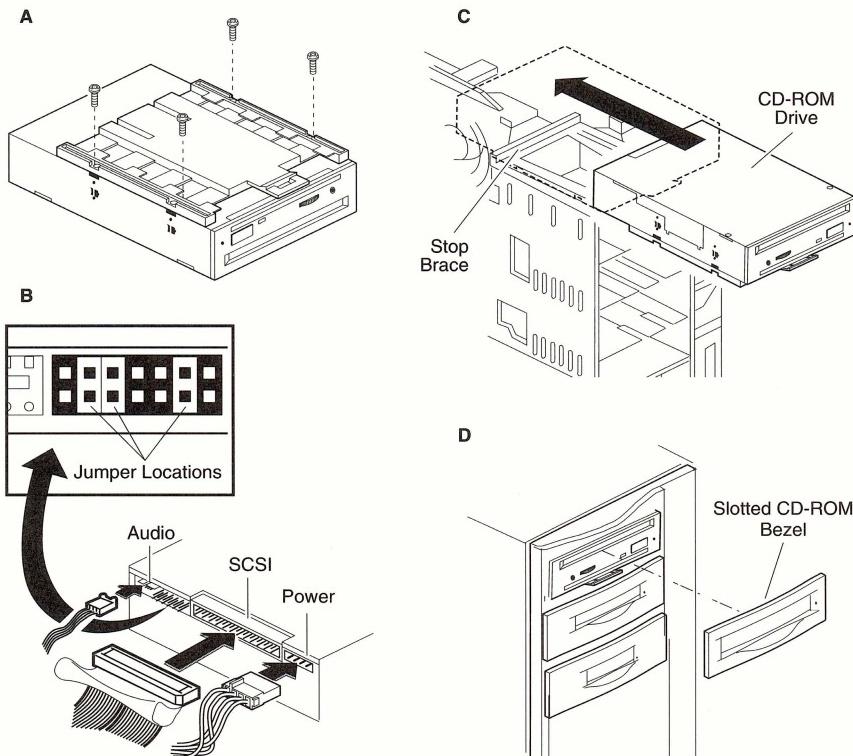


Figure 2 CD-ROM Drive Upgrade

Macintosh Quadra 880/840AV to Power Macintosh 8100/80 or 8100/80AV Upgrade

A Power Macintosh 8100/80 Upgrade Kit upgrades a Macintosh Quadra 800 or a Macintosh Quadra 840AV machine. The upgrade kit ships with two new SCSI cables and a new power cable attached to the logic board. The Quadra 800/840AV cables are NOT compatible with the upgraded system. You must install the new SCSI and power cables provided with the upgrade kit.

1. Remove the top cover, top cover bezels, floppy drive, hard drive, CD-ROM drive (if present), logic board, power supply, and speaker.
2. Remove the LED cable, speaker cable, CD-ROM audio cable, and floppy drive cable from the old logic board and connect them to the new logic board. Install the speaker in the upgraded chassis.
3. Install the customer's original DRAM SIMMs on the upgraded logic board. Return all VRAM and non-matching DRAM SIMMs from the old logic board to the customer.
4. Install the floppy drive, hard drive, CD-ROM drive (if present), power supply, and speaker in the upgraded internal chassis. You must use the new SCSI and power cables. The top SCSI cable connects to the CD-ROM unit. The bottom SCSI cable connects to the hard drive.
5. The Power Macintosh 8100/80 and 8100/80AV MUST have a video card installed for proper bus termination. To upgrade to a Power Macintosh 8100/80, install the Power Macintosh 4 MB Video Card in the PDS slot. To upgrade to a Power Macintosh 8100/80AV, install the Power Macintosh AV Card in the PDS slot.
6. Install the video card at an angle, inserting the back end (the non-connector end) first. Do not force the card into the expansion slot. If the card does not seat properly, remove the card, check the logic board for damage, and try to install the card again. Gently push down on the video card until it snaps into place.
7. Remove the bezels from the old top cover and install them on the new top cover. Copy the computer's serial number from the old top cover to the new top cover. The new cover has blank serial number label.
8. Move the cover screws from the old unit to the new unit and reassemble the computer.
9. Install the system software 7.1.2 that came with the Power Macintosh Logic Board Upgrade Kit. Refer to the user manual provided in the upgrade kit for installation instructions.
10. Run MacTest Pro in the looping mode for 1 hour as a burn-in test.
11. Contact Finished Goods for an RMA number to return the old logic board. Cables do not need to be returned to Apple. Return the logic board in the old housing.

Power Macintosh Cards

Power Macintosh 4 MB Video Card

The Power Macintosh 8100/80 system uses the Power Macintosh 4 MB Video Card (Figure 3). The 4 MB Video Card comes with 2 MB of VRAM, and is expandable to 4 MB by using 512K VRAM SIMMs. The Power Macintosh 8100/80 must have a video card installed in the PDS slot to properly terminate the PDS bus. A missing card can result in a system that won't boot or a system that crashes.

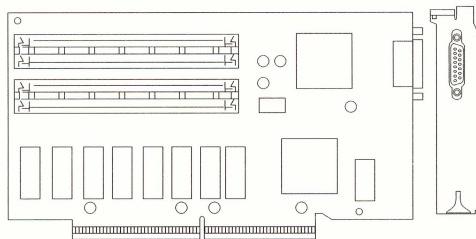


Figure 3 Power Macintosh 4 MB Video Card

Power Macintosh AV Card

The Power Macintosh 8100/80AV system uses the Power Macintosh AV Card (Figure 4). The Power Macintosh 8100/80AV must have the AV card installed in its PDS slot. Two adapters for composite (RCA-type) video connectors come with the AV system. To connect a cable with RCA plugs, connect the RCA plug to one of the adapters, and connect the adapter to the appropriate S-video port (input or output) on the back of your computer.

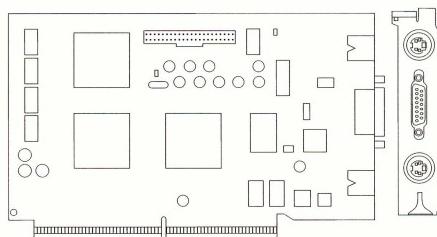
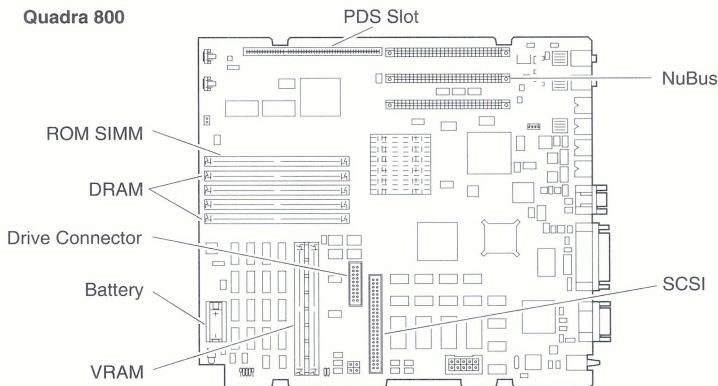


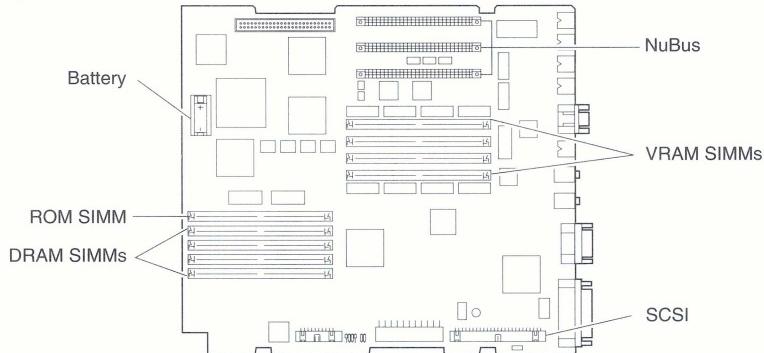
Figure 4 Power Macintosh AV Card

Logic Board Diagrams

Quadra 800



Quadra 840AV



Power Macintosh 8100 and WS 8150

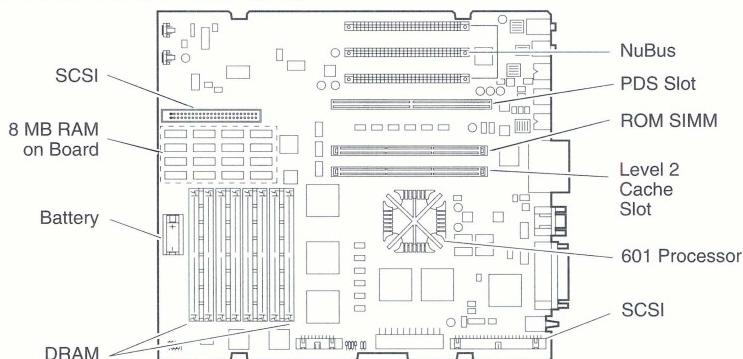


Figure 5 Logic Boards

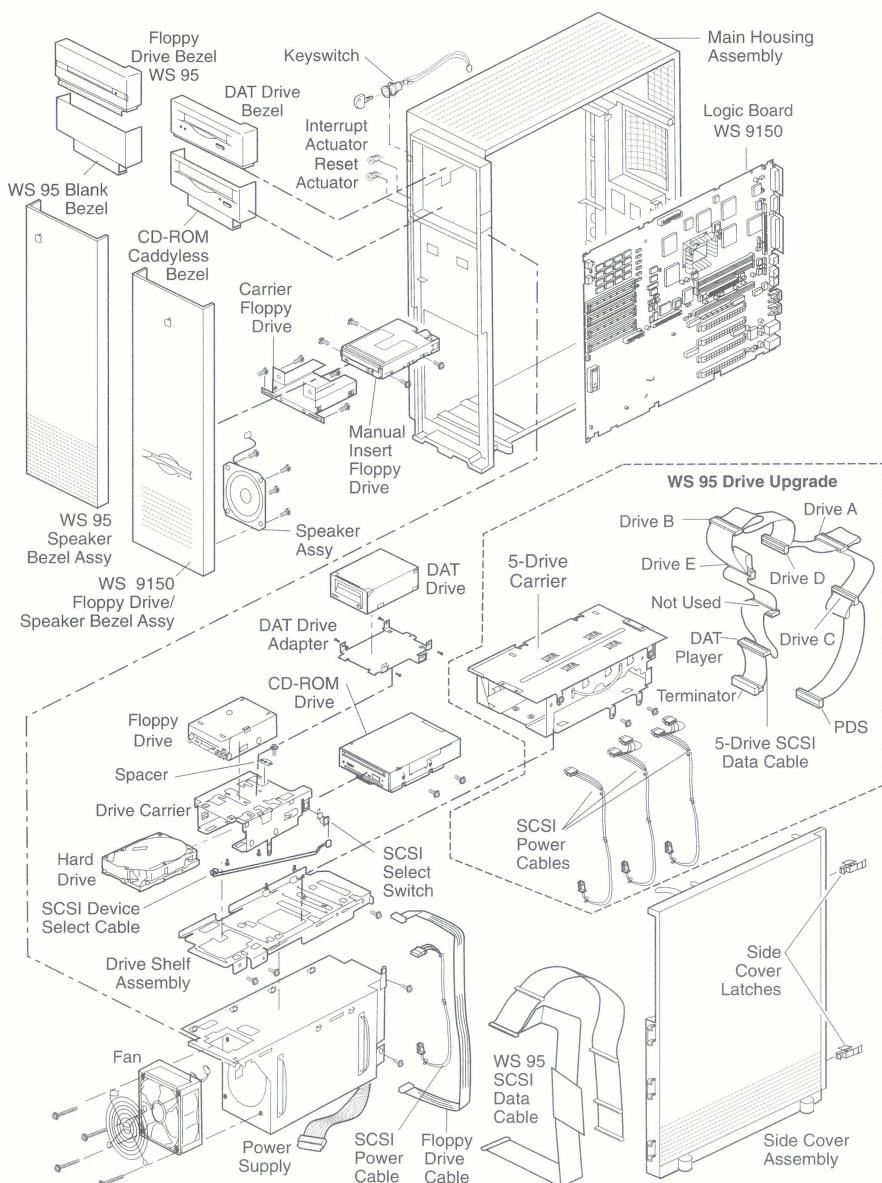
Workgroup Server 95, 9150



1
2

Illustrated Parts List	224
Specifications – WS 95	228
Specifications – WS 9150	229
Symptom/Cure Chart – WS 95	230
Symptom/Cure Chart – WS 9150	235
Reset Logic Board – WS 9150	241
Upgrades	242
Logic Board Diagrams	250

Illustrated Parts List – Workgroup 95, 9150



This is a generic representation of a product family. Configurations may vary.

Figure 1 Exploded View

CD-ROM & Drive Shelf	
Assembly, Drive Shelf (includes velcro cable straps).....	630-6097
Drive Mechanism, Tray Loading, Apple CD 300+	661-0222
Floppy Drive Assembly	
Apple SuperDrive 1.4 MB Drive Mechanism	661-0474
Apple SuperDrive Manual Insert Floppy Drive (WS 9150)	661-0121
Cable, Floppy	590-0515
Cable, Floppy Drive, Mini-T, v2 (WS 9150).....	922-0872
Carrier, Floppy Drive (WS 9150)	922-0973
Drive Carrier, 800K/Apple SuperDrive	805-5050
Screw, Apple SuperDrive	844-0018
Spacer, Apple SuperDrive.....	810-5113
Hard Drive and Drive Shelf Assembly	
Assembly, Drive Shelf (includes velcro cable straps).....	630-6097
Cable, HDA, Power	590-0517
Cable, HDA, Power, Daisy Chain.....	922-0893
Cable, SCSI.....	922-0762
Cable, SCSI Select.....	590-0518
Cable, SCSI Select, 230/500 MB HDA.....	590-0794
Cable, SCSI Select, 400 MB HDA.....	590-0790
Cable, SCSI Select w/switch	922-0894
Cable, SCSI Select w/switch, 1 GB (WS 9150).....	922-0996
Cable, SCSI Select w/switch, 250/500 (WS 9150).....	922-0974
Cable, SCSI Select w/switch, 2 GB (WS 9150).....	922-0894
Cable, SCSI w/terminator.....	590-0528
Carrier, 5-Drive 3.5"	922-0961
Carrier, Hard Drive 3.5/5.25/DDS-DC Drive.....	805-5106
Drive Mechanism, AppleCD 300	661-1646
HDA, 1 GB, 3.5" SCSI	661-0780
HDA, 1 GB, 3.5" SCSI (WS 9150).....	661-0065
HDA, 2 GB, 3.5" SCSI	661-0892
HDA, 160 MB, 3.5" SCSI	661-1647
HDA, 160 MB, 3.5" SCSI.....	661-1641
HDA, 160 MB, 3.5" SCSI.....	661-1649
HDA, 230 MB, 3.5" SCSI.....	661-1637
HDA, 250 MB, 3.5" SCSI, Unhoused	661-0890
HDA, 400 MB, 3.5" SCSI.....	661-1636
HDA, 500 MB, 3.5" SCSI.....	661-0781
HDA, 500 MB, 3.5" SCSI, Unhoused	661-0891
Screw, 6-32 x .250	444-6104
Switch, SCSI Select	705-0045
Logic Board	
Battery, Lithium (without leads)	742-0011

Connector, Jumper (set of 10).....	517-0546
Cover, Battery Holder.....	520-0344
Logic Board (WS 95).....	661-0727
Logic Board (WS 9150).....	661-0132
Logic Board Reset Procedure, Per Repair (WS 9150).....	011-0115
PDS Terminator Board (WS 9150).....	922-0967
SIMM, DRAM, 512K, Cache, Power Macintosh.....	661-0131
SIMM, DRAM, 1 MB, 80 ns	661-0520
SIMM, DRAM, 1 MB, 80 ns	661-0719
SIMM, DRAM, 4 MB, 80 ns, 72-Pin (WS 9150).....	661-0808
SIMM, DRAM, 4 MB x 9, 80 ns, Parity, 30-pin	661-0811
SIMM, DRAM, 8 MB, 80 ns, 72-Pin (WS 9150).....	661-0809
SIMM, VRAM, 128K, 80 ns, 68-pin	661-0722
SIMM, VRAM, 256K, 100 ns (for the 4*8 Display Card).....	661-0609
Main Housing Assembly	
Actuator, Interrupt.....	815-6250
Actuator, Reset.....	815-6249
Assembly, Main Housing (WS 95).....	076-0434
Assembly, Main Housing (WS 9150).....	922-0971
Bezel, Assembly, DAT, Bag of 5 (WS 9150).....	922-0976
Bezel, Blank	076-0431
Bezel, CD, Tray Loading, Bag of 5 (WS 9150).....	922-0978
Bezel, Floppy.....	076-0437
Bezel, Tape Drive.....	922-0854
Keyswitch with two keys.....	705-0175
Light Pipe, Power On	815-6251
Misc. Screw Kit (P/S fan, Light Pipe, Speaker, FD Spacer)....	076-0435
Vent, Fan Exhaust.....	076-0432
Power Supply and Fan Assembly	
Fan, Power Supply	720-0518
Power Supply	661-0664
Side Cover Assembly	
Cover, Side.....	076-0436
Latch, Side Cover.....	815-6262
Speaker Assembly	
Assembly, Speaker	630-6011
Bezel, Speaker (WS 95).....	922-0856
Bezel, Speaker (WS 9150).....	922-0972
Tape Drive	
Adapter, DDS-DC Drive	805-5106
Cable and Switch, SCSI Select, DAT Drive	922-0858
Carrier, DAT (WS 9150).....	922-0977
Carrier, Hard Drive 3.5/5.25/DDS-DC Drive.....	805-5106

Screw, 6-32 x .250	444-6104
Screw, M3.5 x 6 x .8 PNCR Rec	462-4100
Tape Drive, 2 GB DDS-DC SCSI (WS 95).....	661-0795
Tape Drive, DAT, DDS-2, 120 M (WS 9150).....	661-0039
WS 95 PDS Card	
Kit, Bracket, PDS Card.....	076-0129
PDS Card, with bracket.....	661-0794
SIMM, SRAM, 128K, 17 ns, 68-pin	661-0791
SIMM, SRAM, 256K, 17 ns, 68-pin	661-0792
SIMM, SRAM, TAG, 48K, 14 ns, 60-pin	661-0793
Miscellaneous	
Apple Adjustable Keyboard	661-0731
Apple Extended Keyboard II	661-0543
Apple Keyboard II	661-0603
Apple Logo	825-1256
Cable, ADB Keyboard, 2 meter	590-0152
Cable, Mini DIN 8 to Mini DIN 8, MIDI.....	590-0575
Cable, Power Cord	590-0760
Cable, Power Cord, Australia.....	590-0096
Cable, Power Cord, International	590-0094
Cable, Power Cord, UK.....	590-0420
Card, Ethernet NB, AAUI.....	661-0619
Keycap set.....	658-7136
Label, Product ID, Pkg. of 5 (WS 95)	922-0852
Label, Product ID, Bag of 10 (WS 9150)	922-0975
Label, Speaker Bezel, Pkg. of 5 (WS 95).....	922-0860
Misc. Screw Kit (P/S, Fan, Light Pipe, Speaker, FD Spacer) ..	076-0435
Mouse, Apple Desktop Bus II	661-0763
NuBus Cap (WS 9150).....	810-6035
Packing Diskette, 2-sided (for transporting)	003-0003
Service Packaging, 800K/Apple SuperDrive	602-0210
Service Packaging, HDA, 3.5" half-height & 3.5" 1-height	602-0282
Service Packaging, HDA, 3.5", 1 high drive w/o carriers.....	602-0308

Specifications – Workgroup Server 95

Processor	Motorola 68040 microprocessor; 33 MHz; built-in paged memory management unit (PMMU), floating-point unit (FPU), and 8K memory cache Addressing: 32-bit internal registers, address, data bus
Memory	DRAM: 16, 32, or 48 MB parity RAM, expandable to 256 MB ROM: 1 MB PRAM: 256 bytes of parameter memory Clock/Calendar: ASIC clock chip with PRAM and DFAC support and seven-year lithium battery
Disk Storage	Floppy Drive: Internal 1.4 MB Apple SuperDrive Hard Drive: 230, 500, 1000, or 2000 MB hard drive DDS-DC Drive: 2 GB digital data storage compression drive for 4 mm tape backup (optional)
I/O Interfaces	ADB: One Apple Desktop Bus (ADB) port SCSI: One external port; DB-25 connector Expansion Slot: One 68040 processor-direct slot (PDS); 140-pin connector NuBus: Five slots support standard and oversize cards, burst-mode transfers, a processor write buffer, and NuBus '90; 96-pin Euro-DIN connectors Serial: Two RS-232/RS-422 ports; mini DIN-8 connectors Sound: 8-bit stereo output; 8-bit monoaural input Video: Supports Apple monitors (8-bit), VGA monitors, and NTSC and PAL video standards Ethernet: One Ethernet port, AAUI-15 connector
Sound and Video	Microphone: Built-in electret omnidirectional microphone; output voltage is 4 mV peak-to-peak at normal value Sound: Four-voice, wavetable synthesis; stereo sampling generator Video Display: Built-in 8-bit video circuitry (upgradable to 24-bit); supports Apple 8-bit monitors and many non-Apple monitor types (NTSC, PAL, VGA)
Electrical	Line Voltage: 100-240 VAC Frequency: 50-60 Hz Maximum Power: 303 W
Physical	Height: 16.8 in. (473 mm) Width: 8.9 in. (224 mm) Depth: 20.6 in. (523 mm) Weight: 36 lb. (16.7 kg) without hard drive

Specifications – Workgroup Server 9150

Processor	80 MHz PowerPC 601 RISC microprocessor; built-in MMU and FPU; 32 K of on-chip cache memory; requires system software version 7.1.2 or later
Memory	DRAM: 8 MB RAM soldered on logic board, expandable to 264 MB via 8 SIMM sockets on logic board (using like pairs, 80 ns or faster, 72-pin noncomposite SIMMs) ROM: 4 MB VRAM: None; DRAM video support provided on logic board Cache: 32 K on-chip cache; 512 K level 2 cache SIMM Clock/Calendar: Custom chip with long-life lithium battery
Disk Storage	Floppy Drive: 1.4 Apple SuperDrive Manual Insert Hard Drive: 1000 or 2000 MB hard drive CD-ROM Drive: Internal AppleCD 300i Plus DAT Drive: Optional DDS-2 DAT tape drive; 120 M tape supported
I/O Interfaces	ADB: One Apple Desktop Bus port; mini DIN-4 connector; maximum power draw: 500 mA SCSI: One external port; DB-25 connector Expansion Slot (terminator card must be installed): One Power Macintosh video slot; 182-pin connector NuBus: Four slots support long or short expansion cards; 96-pin Euro-DIN connectors Serial: Two RS-232/RS-422 ports; mini DIN-9 connectors (backward compatible with mini DIN-8 connectors) Sound: 8-bit stereo input; 16-bit stereo output Video: One DB-15 DRAM-based video port on logic board Ethernet: One Ethernet port, AAUI-15 connector
I/O Devices	Keyboard: Standard or extended keyboard, draws 25-80 mA Mouse: ADB mouse, draws up to 10 mA Microphone: Optional electret, omnidirectional microphone
Video Display	Supports monochrome, color, VGA, SVGA formats, including Macintosh 12" Monochrome Display, Macintosh 12" RGB Display, AppleColor High-Res RGB 14" Monitor, Apple AudioVision 14 Display, Macintosh Color Display, Macintosh 15" Portrait Display, and Macintosh 16" Color Display
Electrical	Line Voltage: 100-240 VAC Frequency: 50-60 Hz Input Power: 600 W maximum, not including monitor power DC Output Power: 303 W maximum
Physical	Height: 16.8 in. (473 mm) Width: 8.9 in. (224 mm) Depth: 20.6 in. (523 mm) Weight: 36 lb. (16.7 kg) without hard drive

Symptom/Cure Chart – Workgroup Server 95

Video Problems	Solutions
Screen is black, audio and drive operate, fan is running, and LED is lit	<ol style="list-style-type: none">1. Adjust brightness on monitor.2. Replace monitor.3. Replace video cable.4. If a video interface card is installed, move it to a different slot.5. Replace video interface card, if installed.6. Clear parameter RAM. Make sure Caps Lock key is up.7. Replace SIMMs.8. Replace logic board. Move customer's SIMMs to new logic board.
Screen is black, audio and drive do not operate, but fan is running and LED is lit	<ol style="list-style-type: none">1. Replace video cable.2. If a video interface card is installed, move it to a different slot.3. Replace SIMMs.4. Replace logic board. Move customer's SIMMs to new logic board.5. Replace power supply.
Partial or whole screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none">1. Replace monitor.2. Replace video cable.3. If a video interface card is installed, move it to a different slot.4. Replace vide interface card, if installed.5. Clear parameter RAM. Make sure Caps Lock key is up.6. Replace logic board. Move customer's SIMMs to new logic board.
Floppy Drive Problems	Solutions
Internal floppy drive does not operate	<ol style="list-style-type: none">1. Verify that keyswitch is set to 1.2. Replace disk with known-good floppy disk.3. Replace floppy drive cable.4. Replace floppy drive.5. Replace logic board. Move customer's SIMMs to new logic board.6. Replace power supply.
During system startup disk ejects; display shows icon with blinking "X"	<ol style="list-style-type: none">1. Verify that keyswitch is set to 1.2. Replace disk with known-good system disk.3. Clear parameter RAM. Make sure Caps Lock key is up.4. Replace floppy drive cable.5. Replace floppy drive.6. Replace logic board. Move customer's SIMMs to new logic board.

	Solutions
Does not eject disk	<ol style="list-style-type: none">1. Verify that keyswitch is set to 1.2. Switch off computer. Hold mouse button down while you switch computer on.3. Replace floppy drive.4. Replace floppy drive cable.5. Replace logic board. Move customer's SIMMs to new logic board.
Attempts to eject disk, but doesn't	<ol style="list-style-type: none">1. Push disk completely in.2. Reseat floppy drive bezel and drive so bezel slot aligns correctly with drive.3. Eject disk manually.4. Replace floppy drive.
Internal floppy drive runs continuously	<ol style="list-style-type: none">1. Replace disk with known-good system disk.2. Replace floppy drive cable.3. Replace floppy drive.4. Replace logic board. Move customer's SIMMs to new logic board.
Drive does not recognize MS-DOS disks	<ol style="list-style-type: none">1. To read and write MS-DOS files, format all disks with MS-DOS drive first.2. Macintosh PC Exchange or Apple File Exchange must be used.
Hard Drive Problems	
Single internal hard drive doesn't spin	<ol style="list-style-type: none">1. Replace hard drive data cable.2. Replace hard drive power cable.3. Replace hard drive.
No internal hard drives operate	<ol style="list-style-type: none">1. Verify there are no duplicate SCSI device addresses.2. Replace hard drive data cable.3. Replace power supply.4. Replace logic board. Move customer's SIMMs to new logic board.
Drive does not appear on the desktop	<ol style="list-style-type: none">1. Verify there are no duplicate SCSI device addresses.2. If drive is not initialized, use HD SC Setup to initialize.
Works with internal or external SCSI device, but does not work with both	<ol style="list-style-type: none">1. Verify that each SCSI device is set to a unique SCSI ID number.2. Verify that hard drive is terminated but optional CD-ROM drive is not terminated.3. Replace terminator on external hard drive.4. Replace SCSI select cable on external SCSI device.

Peripheral Problems	Solutions
Cursor does not move	<ol style="list-style-type: none"> 1. Verify that keyswitch is set to 1. 2. Check mouse connection. 3. Inspect inside of mouse for buildup of dirt or other contaminants. Clean mouse if necessary. 4. If mouse was connected to keyboard, connect it to a computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse. 5. Replace logic board. Move customer's SIMMs to new logic board.
Cursor moves, but clicking the mouse button has no effect	<ol style="list-style-type: none"> 1. Replace mouse. 2. Replace logic board. Move customer's SIMMs to new logic board.
Double-click doesn't open application, disk, or server	<ol style="list-style-type: none"> 1. Remove duplicate system folders. 2. Clear parameter RAM. Make sure Caps Lock key is up. 3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse. 4. Replace logic board. Move customer's SIMMs to new logic board.
No response to any key on the keyboard	<ol style="list-style-type: none"> 1. Verify that keyswitch is not set to 1. 2. Check keyboard connection to ADB port. 3. Replace keyboard cable. 4. Replace keyboard. 5. Replace logic board. Move customer's SIMMs to new logic board.
Known-good serial printer will not print	<ol style="list-style-type: none"> 1. Verify that system software is version 7.0.1 or later. 2. Make sure Chooser and control panel settings are correct. 3. Replace printer interface cable. 4. Replace logic board. Move customer's SIMMs to new logic board.
Known-good printer on AppleTalk network will not print	<ol style="list-style-type: none"> 1. Verify that system software is version 7.0.1 or later. 2. Make sure Chooser and control panel settings are correct. 3. Verify AppleTalk connectors are known-good. 4. Replace logic board. Move customer's SIMMs to new logic board.

System Problems	Solutions
Does not power on; screen is black, fan is not running, and LED is not lit	<ol style="list-style-type: none">1. Verify that keyswitch is not set to 0.2. Check power cables.3. Plug monitor directly into wall socket and verify that monitor has power.4. Replace power cord.5. Verify keyboard is known-good.6. Replace power supply.7. Replace logic board. Move customer's SIMMs to new logic board.
Power supply clicks or chirps	<ol style="list-style-type: none">1. Replace floppy drive cable.2. Replace floppy drive.3. Replace power supply.4. Replace logic board. Move customer's SIMMs to new logic board.
System shuts down intermittently	<ol style="list-style-type: none">1. Make sure air vents on side and rear of computer are clear. Thermal protection circuitry may shut down system. After 35 to 40 minutes, system should be OK.2. Replace power cord.3. Check battery. (See Lithium Battery Verification in Chapter 2, General Information.)4. Replace power supply.5. Replace logic board. Move customer's SIMMs to new logic board.
System intermittently crashes or hangs	<ol style="list-style-type: none">1. Verify that system software is correct version.2. Verify that software is known-good.3. Verify that software is A/UX compatible.4. Clear parameter RAM. Make sure Caps Lock key is up.5. Replace SIMMs.6. Replace logic board. Move customer's SIMMs to new logic board.7. Replace power supply.
Miscellaneous Problems	Solutions
No sound from speaker	<ol style="list-style-type: none">1. Verify that Volume control panel setting is 1 or above.2. Replace speaker.3. Replace logic board. Move customer's SIMMs to new logic board.

Error Chords	Solutions
One-part error chord sounds during startup sequence	<ol style="list-style-type: none">1. Disconnect SCSI data cable from logic board and reboot system. If startup sequence is normal, initialize hard drive. If error chord still sounds, replace hard drive.2. Disconnect floppy drive cable connector and reboot system. If startup sequence is normal, replace floppy drive.3. Replace logic board. Move customer's SIMMs to new logic board.
Two-part error chord sounds during startup sequence	<ol style="list-style-type: none">1. Perform SIMM verification.2. Replace logic board. Move customer's SIMMs to new logic board.

Symptom/Cure Chart – Workgroup Server 9150

Video Problems	Solutions
Screen is black, audio and drive operate, fan is running, and LED is lit	<ol style="list-style-type: none">1. Adjust brightness on monitor.2. Replace video cable.3. Try using known-good RAM SIMMs.4. Replace video card (if present).5. Clear parameter RAM. Make sure Caps Lock key is up.6. Replace SIMMs.7. Replace monitor.8. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.9. Replace logic board. Move customer's SIMMs to new logic board.10. Replace power supply.
Screen is black, audio and drive do not operate, but fan is running and LED is lit	<ol style="list-style-type: none">1. Replace video cable.2. Replace video card (if present).3. Replace SIMMs.4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.5. Replace logic board. Move customer's SIMMs to new logic board.6. Replace power supply.
Partial or whole screen is bright and audio is present, but no video information is visible	<ol style="list-style-type: none">1. Replace video cable.2. Replace video card (if present).3. Clear parameter RAM. Make sure Caps Lock key is up.4. Replace monitor.5. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.6. Replace logic board. Move customer's SIMMs to new logic board.
Floppy Drive Problems	Solutions
Internal floppy drive does not operate	<ol style="list-style-type: none">1. Replace disk with known-good floppy disk.2. Replace floppy drive cable.3. Replace floppy drive.4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.5. Replace logic board. Move customer's SIMMs to new logic board.6. Replace power supply.

1
2

	Solutions
During system startup disk ejects; display shows icon with blinking "X"	<ol style="list-style-type: none"> 1. Replace disk with known-good system disk. 2. Clear parameter RAM. Make sure Caps Lock key is up. 3. Replace floppy drive cable. 4. Replace floppy drive. 5. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card. 6. Replace logic board. Move customer's SIMMs to new logic board.
Does not eject disk	<ol style="list-style-type: none"> 1. Switch off computer. Hold mouse button down while you switch computer on. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card. 5. Replace logic board. Move customer's SIMMs to new logic board.
Attempts to eject disk, but doesn't	<ol style="list-style-type: none"> 1. Push disk completely in. 2. Reseat floppy drive bezel and drive so bezel slot aligns correctly with drive. 3. Eject disk manually. 4. Replace floppy drive.
Internal floppy drive runs continuously	<ol style="list-style-type: none"> 1. Replace disk with known-good floppy disk. 2. Replace floppy drive cable. 3. Replace floppy drive. 4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card. 5. Replace logic board. Move customer's SIMMs to new logic board.
Drive does not recognize MS-DOS disks	<ol style="list-style-type: none"> 1. To read and write MS-DOS files, format all disks with MS-DOS drive first.
CD-ROM Drive Problems	
CD-ROM drive does not accept compact disc	<ol style="list-style-type: none"> 1. Exchange disc. 2. Replace CD-ROM drive mechanism.
Macintosh does not display CD-ROM drive icon	<ol style="list-style-type: none"> 1. Verify that CD-ROM software is installed. 2. Replace SCSI data cable. 3. Replace CD-ROM drive mechanism.

Hard Drive Problems	Solutions
Single internal hard drive will not operate; drive doesn't spin	<ol style="list-style-type: none">1. Update driver software of hard drive using HD SC Setup.2. Reinstall system software.3. Replace hard drive power cable.4. Replace hard drive.5. Replace SCSI cable.6. Replace power supply.
No internal SCSI hard drives operate	<ol style="list-style-type: none">1. Verify there are no duplicate SCSI device addresses.2. Replace SCSI data cable.3. Replace power supply.4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.5. Replace logic board. Move customer's SIMMs to new logic board.
Drive does not appear on the desktop	<ol style="list-style-type: none">1. Verify there are no duplicate SCSI device addresses.2. If drive is not initialized, use HD SC Setup to initialize.3. Replace SCSI cable.4. Replace hard drive.
Works with internal or external SCSI device, but does not work with both	<ol style="list-style-type: none">1. Verify that each SCSI device is set to a unique SCSI ID number.2. Verify that hard drive is terminated but optional CD-ROM drive is not terminated.3. Replace terminator on external hard drive.4. Replace SCSI select cable on external SCSI device.
Peripheral Problems	Solutions
Cursor does not move	<ol style="list-style-type: none">1. Inspect inside of mouse for buildup of dirt or other contaminants. Clean mouse if necessary.2. Reinstall the system software.3. Replace external SCSI cables.4. Verify that there is only one terminator on external devices.5. Check mouse connection.6. If mouse was connected to keyboard, connect it to a computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse.7. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.8. Replace logic board. Move customer's SIMMs to new logic board.

Cursor moves, but clicking the mouse button has no effect	<ol style="list-style-type: none"> 1. Replace mouse. 2. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card. 3. Replace logic board. Move customer's SIMMs to new logic board.
Double-click doesn't open application, disk, or server	<ol style="list-style-type: none"> 1. Remove duplicate system folders. 2. Clear parameter RAM. Make sure Caps Lock key is up. 3. If mouse was connected to keyboard, connect mouse to computer ADB port instead. If mouse works, replace keyboard. If mouse does not work in any ADB port on computer, replace mouse. 4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card. 5. Replace logic board. Move customer's SIMMs to new logic board.
No response to any key on the keyboard	<ol style="list-style-type: none"> 1. Check keyboard connection to ADB port. 2. Replace keyboard cable. 3. Replace keyboard. 4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card. 5. Replace logic board. Move customer's SIMMs to new logic board.
Known-good serial printer does not work	<ol style="list-style-type: none"> 1. Verify that system software is version 7.1.2 or later. 2. Verify that Chooser is set correctly. 3. Replace printer interface cable. 4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card. 5. Replace logic board. Move customer's SIMMs to new logic board.
Known-good network printer does not print	<ol style="list-style-type: none"> 1. Verify that system software is version 7.1.2 or later. 2. Verify that Chooser is set correctly. 3. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card. 4. Replace logic board. Move customer's SIMMs to new logic board.

System Problems	Solutions
Does not power on; screen is black, fan is not running, and LED is not lit	<ol style="list-style-type: none">1. Check power cables.2. Plug monitor directly into wall socket and verify that monitor has power.3. Reset logic board. (See "Reset Logic Board.")4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.5. Replace power cord.6. Replace power supply.7. Replace logic board. Move customer's SIMMs to new logic board.
Power supply clicks or chirps	<ol style="list-style-type: none">1. Replace power supply.2. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.3. Replace logic board. Move customer's SIMMs to new logic board.4. Replace floppy drive cable.5. Replace floppy drive.
System shuts down intermittently	<ol style="list-style-type: none">1. Make sure air vents on side and rear of computer are clear. Thermal protection circuitry may shut down system. After 35 to 40 minutes, system should be OK.2. Reset logic board. (See "Reset Logic Board.")3. Replace power supply.4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.5. Replace logic board. Move customer's SIMMs to new logic board.
System intermittently crashes or hangs	<ol style="list-style-type: none">1. Verify that system software is version 7.1.2 or later.2. Verify SIMMs are noncomposite and installed in like pairs (same size and speed).3. Verify that software is known-good and Power Macintosh compatible.4. Verify that a terminator card or video card is installed in the PDS slot.5. Clear parameter RAM. Make sure Caps Lock key is up.6. Replace SIMMs.7. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.8. Replace logic board. Move customer's SIMMs to new logic board.9. Replace power supply.

-
- During startup, following message is displayed, "This startup disk will not work on this Macintosh model."
1. Verify that startup disk is good.
 2. Attach LED cable to logic board.
 3. Replace LED cable.
 4. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.
 5. Replace logic board. Move customer's SIMMs to new logic board.

Power Supply Problems	Solutions
------------------------------	------------------

- System does not power up
1. Reset logic board. (See "Reset Logic Board.")
 2. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.
 3. Replace power supply.
 4. Replace logic board.

Miscellaneous Problems	Solutions
-------------------------------	------------------

- No sound from speaker
1. Verify that Volume control panel setting is 1 or above.
 2. Replace speaker.
 3. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.
 4. Replace logic board. Move customer's SIMMs to new logic board.
- About This Macintosh reports more or less memory than is installed
1. Check to see if virtual memory is turned on (which will cause the system to report more memory).
 2. Verify that RAM SIMMs are installed in matching pairs (same size and speed).
 3. Replace RAM SIMMs.

Error Chords	Solutions
---------------------	------------------

- One-part error chord sounds during startup sequence
1. Disconnect SCSI data cable from logic board and reboot system. If startup sequence is normal, initialize hard drive. If error chord still sounds, replace hard drive.
 2. Disconnect floppy drive cable connector and reboot system. If startup sequence is normal, replace floppy drive.
 3. Reseat ROM SIMM, RAM SIMM, cache SIMM, and terminator card.
 4. Replace logic board. Move customer's SIMMs to new logic board.

Reset Logic Board – Workgroup Server 9150

Whenever you have a unit that fails to power up, you should follow this procedure to reset the logic board BEFORE replacing any modules. If this procedure resolves the problem, claim an adjustment on an SRO. If not, replace the defective component and DO NOT claim an adjustment.

This procedure resets PRAM. Be sure to check the computer's time, date, and other system parameter settings after you perform the procedure.

1. Unplug the computer and remove the top cover.

▲ Warning

If handled or discarded improperly, the lithium battery in the computer could explode. Review “Battery and AC Adapter Verification” in Chapter 2, General Information.

2. Unplug the power supply from the logic board.
3. Using a small flat-blade screwdriver, pry open the latch at the end of the battery holder and lift off the cover.
4. Grasp the battery and remove it from the holder.
5. Press the computer's power-on button. Verify that the power supply cable is disconnected from the logic board. Wait 5-10 minutes and replace the battery (make sure the battery faces the correct direction).
6. Reassemble the computer.

1
2

CD-ROM Drive Upgrade

1. Remove the cover, drive shelf, floppy drive, and speaker bezel.
2. Remove any SCSI device installed beneath the floppy drive.
3. Remove the blank bezel. Install the slotted CD-ROM drive bezel. Reinstall the speaker bezel.
4. Connect the audio and CD-ROM drive power cables to the CD-ROM drive.
5. Install the CD-ROM drive on the drive shelf in the front position.
6. Set the SCSI ID number on the CD-ROM drive. Make sure the ID number is unique from any other internal SCSI device. Apple recommends SCSI ID number 5.
7. Reinstall the floppy drive on the CD-ROM drive carrier. Reinstall the drive shelf and drives into the computer.
8. Connect the audio cable to the logic board. Reconnect the SCSI data cable to all SCSI devices.
9. Reconnect the SCSI power cables to the power supply.

Quadra 900/950 to WS 95 Upgrade

The Workgroup Server 95 upgrade kit upgrades a Macintosh Quadra 900 or 950 to a Workgroup Server 95. The upgrade kit includes a processor-direct slot (PDS) card and a CD with A/UX 3.01 and Retrospect backup software.

1. Remove the cover.
2. Remove the plastic cover plate behind the processor-direct slot.
3. Disconnect the SCSI data cable from the logic board.
4. Install the Workgroup Server 95 PDS card in the PDS slot.
5. Connect the SCSI data cable to the 50-pin connector at the top of the Workgroup Server 95 PDS card.
6. Install the A/UX 3.01 and Retrospect software.

WS 95 Memory Cache Upgrade

The Workgroup Server cache card upgrade increases the amount of RAM cache from 128K to 256K or 512K.

1. Remove the cover, and WS 95 PDS card (Figure 2).
2. Install the SIMMs as indicated in the table below.

Upgrade to	Install
256 K	128 K SRAM SIMM TAG SIMM
512 K	128 K SRAM SIMM 256 K SRAM SIMM TAG SIMM

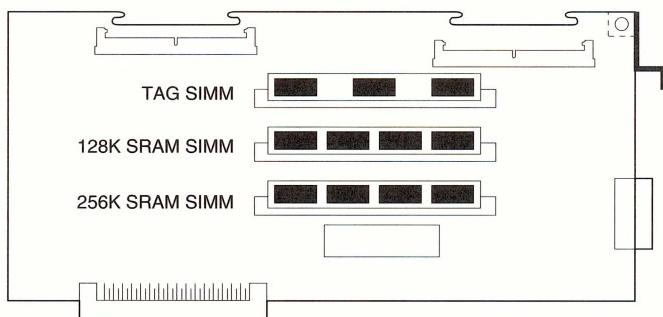


Figure 2 WS 95 Cache Card

WS 95 Tape Drive Upgrade

The DDS-DC drive upgrade kit adds a digital data storage-data compression drive to a Workgroup Server 95 or to a Macintosh Quadra 900 or Quadra 950 with the Workgroup Server PDS card.

1. Remove the cover, drive shelf, floppy drive, and speaker bezel.
2. Remove any SCSI device installed beneath the floppy drive.
3. Install the DDS-DC drive on the drive shelf in the front position.
4. Set the SCSI ID number on the DDS-DC drive. Make sure the ID number is unique from any other internal SCSI device. Apple recommends SCSI ID number 5.
5. Attach the floppy drive on the carrier to the DDS-DC drive. Reinstall the drive shelf and drives into the computer.
6. Squeeze the two plastic latches on the inside of the blank bezel. Remove the blank bezel from the front of the computer.
7. Install the DDS-DC drive bezel. Replace the speaker bezel and cover.

WS 95 Five-Drive Upgrade

In addition to the hard drive and their related hardware, you will need the following parts, which are illustrated in Figure 3, to upgrade the WS 95 so that it can hold up to five 3.5" hard drives:

- The five-drive bracket kit
- Five SCSI ID select switches (part number depends on the drive type)
- The five-drive SCSI cable with terminator
- Two hard drive power cables with two drive connectors each
- One hard drive power cable with one drive connector (already in existing unit)

Refer to Hard Drive Upgrade in this chapter for installation procedures.

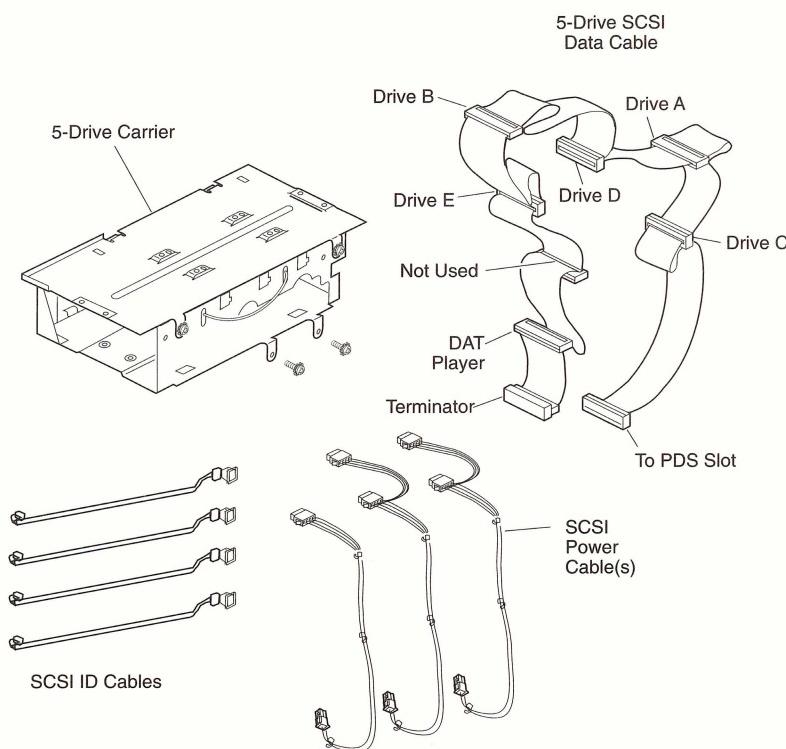


Figure 3 WS 95 Five-Drive Upgrade Parts

WS 95 and WS 9150 Hard Drive Upgrade

The hard drive bracket holds up to five hard drives. This procedure explains how to install hard drives in the 5-drive bracket and how to connect the SCSI cable.

1. Remove the cover and two screws that secure the 5-drive bracket to the drive shelf assembly (Figure 4a-1).
2. Remove the two screws that secure the top of the 5-drive carrier to the bottom piece. Remove the drive bracket top (Figure 4a-2).
3. There are five openings in the bottom panel of the drive bracket for the SCSI ID switches. The openings are labeled A-E. To install the SCSI ID switch for the first drive, feed the connector end of the SCSI ID cable through the opening labeled A on the drive bracket. Push in the SCSI ID switch until it clicks into place. Repeat this procedure to install the remaining SCSI ID switches (Figure 4a-3).
4. Connect the free end of the first SCSI ID switch cable to the first hard drive, which you will be installing in drive slot A (Figure 4a-4).
5. Set the SCSI ID numbers. Make sure no two peripherals, including the DAT player, use the same SCSI ID number. Also, do not set any of the SCSI ID switches to 7. The hard drives must be installed in the five-drive bracket in the order shown. If you install fewer than five drives, you must still install the drives in the order shown (Figure 4a-5).
6. Remove the terminating resistors from the drives (Figure 4a-6).
7. Install the first hard drive in slot A (the lower-right slot) of the drive bracket. Insert the four screws that secure the hard drive to the drive bracket. Tighten the screws. Follow this procedure to install up to four additional hard drives in the order shown (Figure 4a-7).

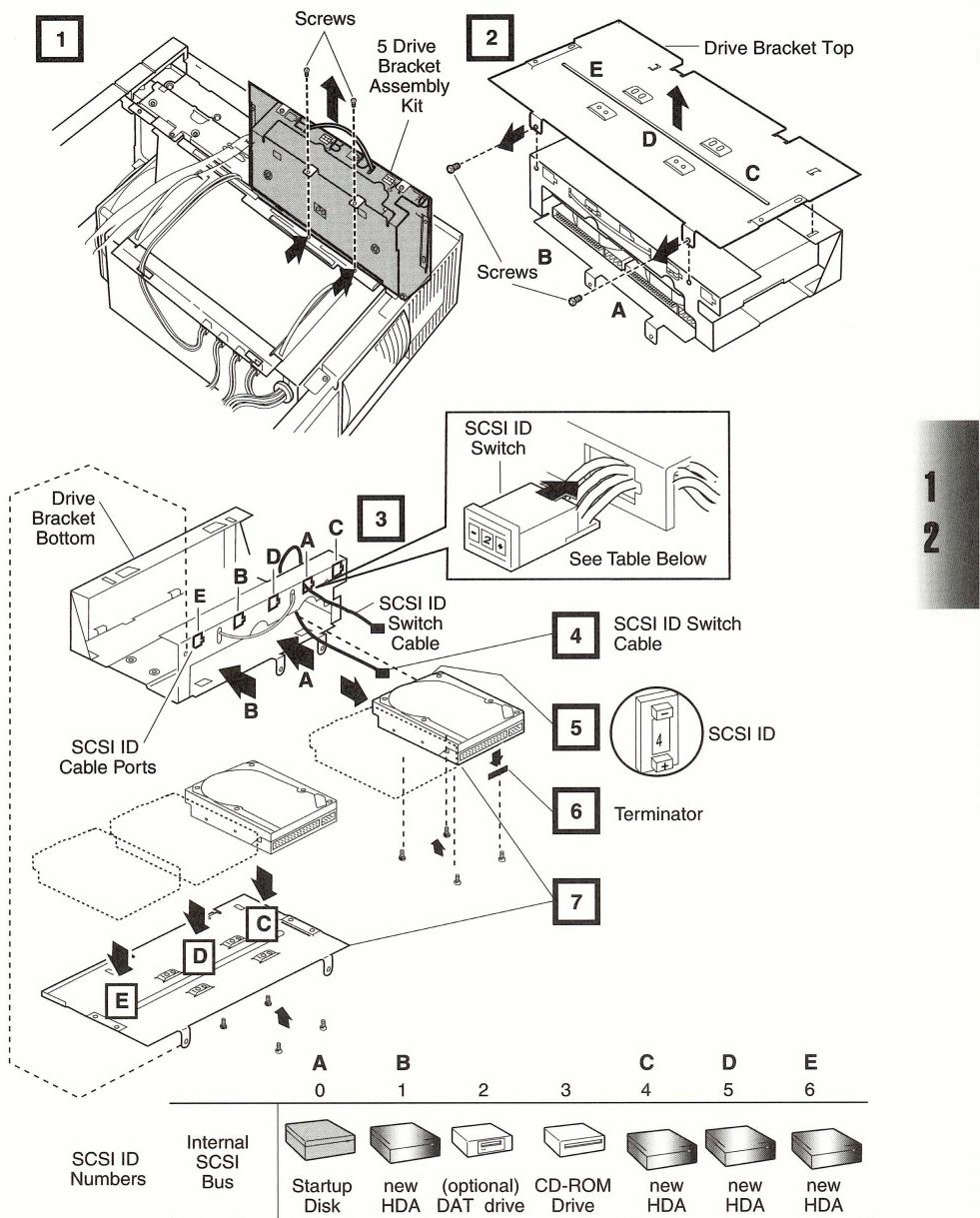


Figure 4a Hard Drive Upgrade

-
- 8. Once you have installed all the hard drives, replace the top of the drive bracket. Replace the two screws that secure the top of the drive bracket to the bottom of the drive bracket (Figure 4b-8).
 - 9. Attach the hard drive power cables (Figure 4b-9).
 - 10. The SCSI data cable connects up to five hard drives and one DAT player. Figure 4b-10 indicates which connectors attach to which peripherals. Connect the DAT player first. If fewer than six peripherals are present, leave the connectors for the missing peripherals disconnected. Pull through the cable that connects the floppy drive (if present) to the PDS card so that the cable will not obstruct the insertion of the drive bracket.
 - 11. Attach the drive E connector on the 5-drive SCSI cable to the hard drive in slot E. Fold over the cable and attach the drive B connector to the drive in slot B (Figure 4b-11).
 - 12. Attach the drive D connector on the 5-drive SCSI cable to the hard drive in slot D. Fold over the cable and attach the drive A connector to the drive in slot A (Figure 4b-11).
 - 13. Fold over the cable and attach the drive C connector to the drive in slot C (Figure 4b-11).
 - 14. Attach the end of the 5-drive SCSI cable to the hard drive connector on the logic board on the WGS 9150 or to the PDS card on the AWS 95 (Figure 4b-12).

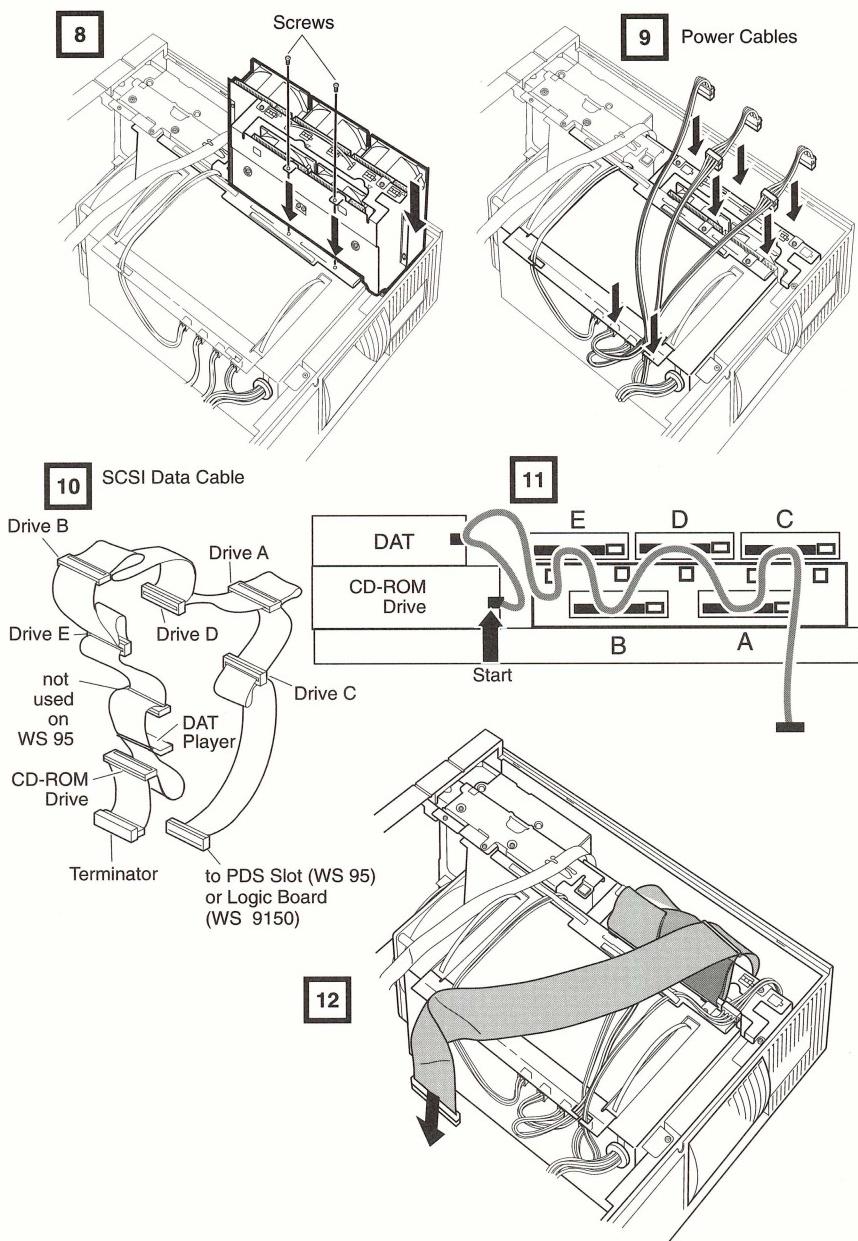
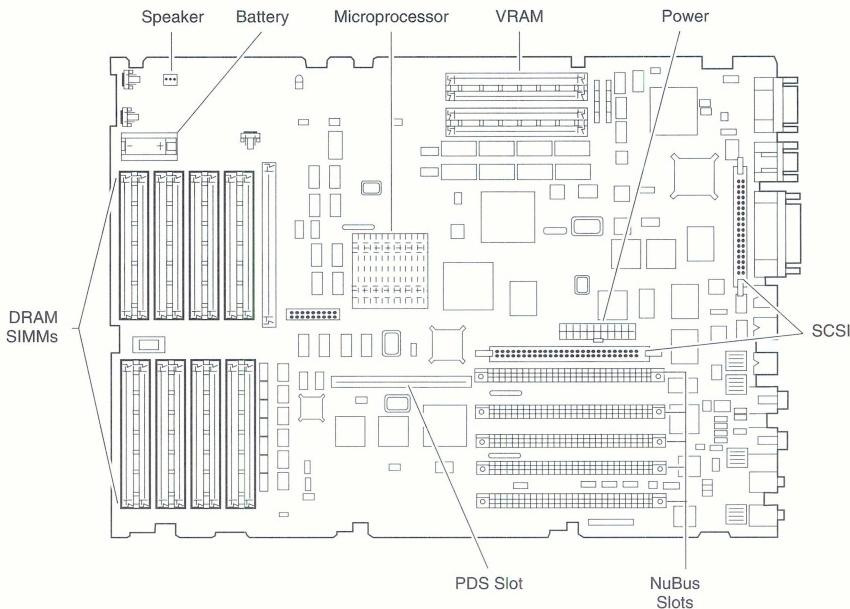


Figure 4b Hard Drive Upgrade

Logic Board Diagrams

WS 95



WS 9150

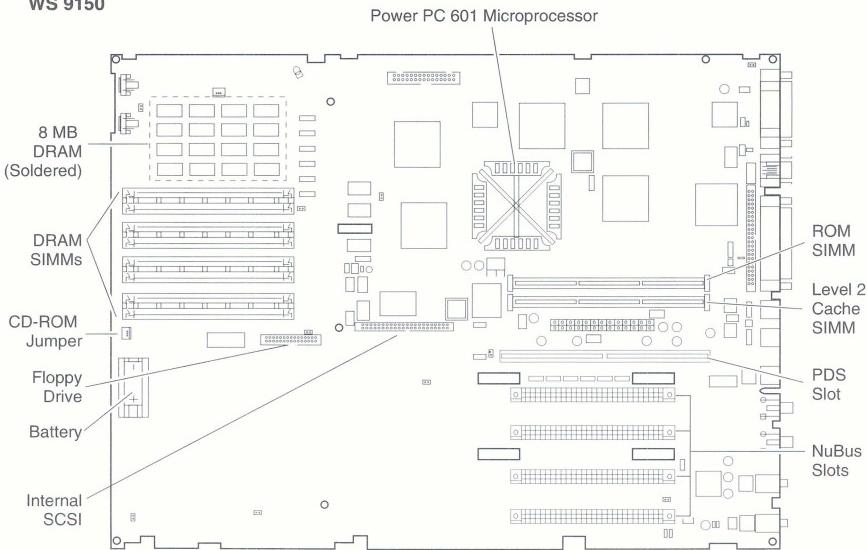
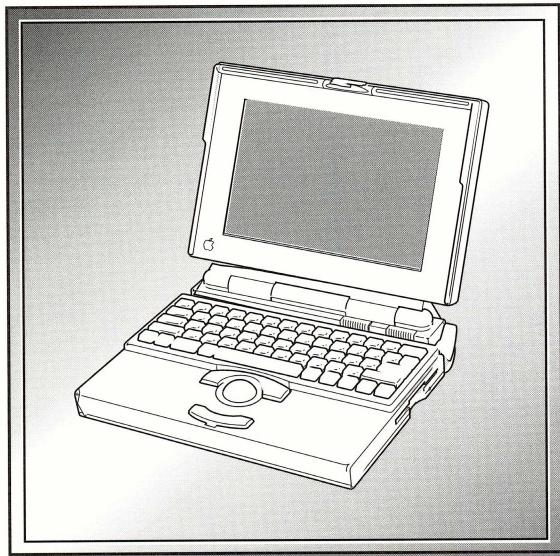


Figure 5 Logic Boards

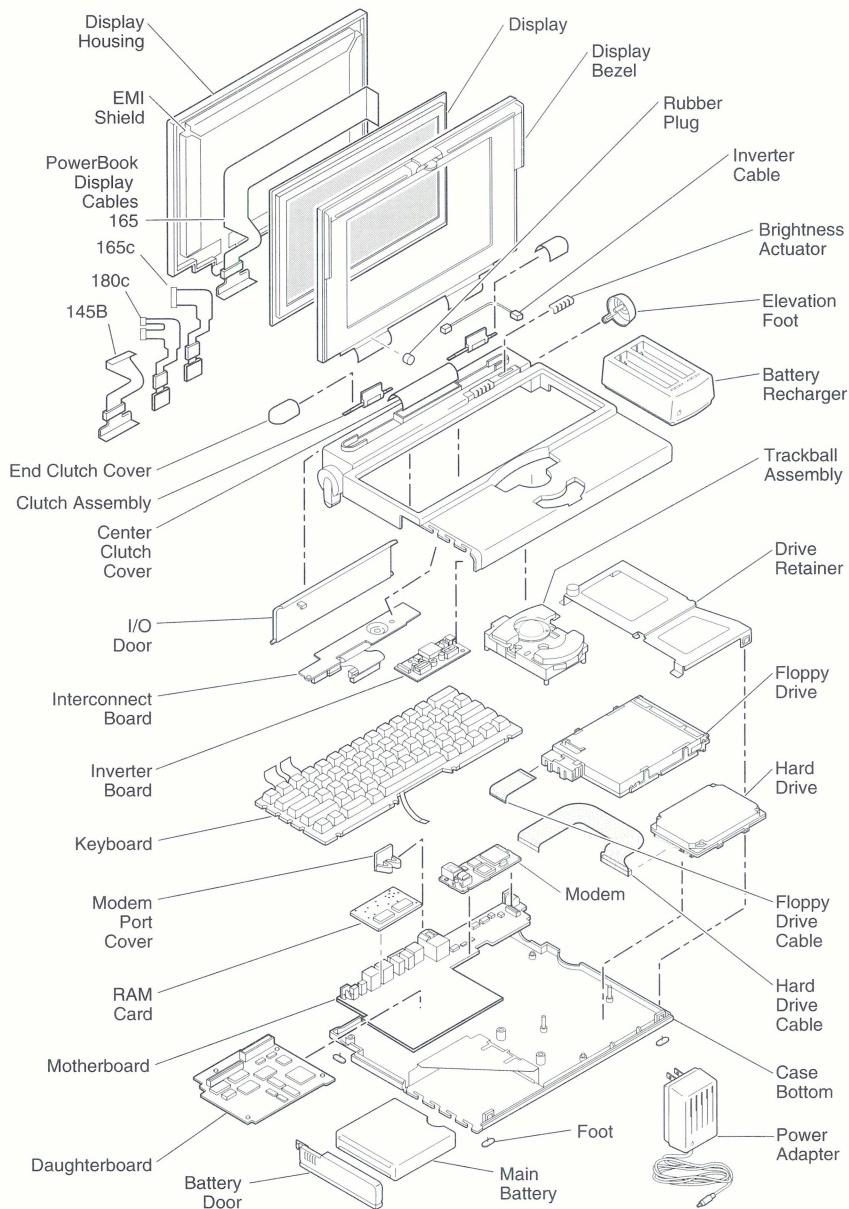
PowerBook 145B, 165, 165c, 180c



1
3

Illustrated Parts List	252
Specifications	257
PowerBook Basics	259
Symptom/Cure Chart	260
Troubleshooting Flowchart	269
Additional Procedures	271
Motherboard and Daughterboard Diagrams	276

Illustrated Parts List – Powerbook 145B, 165, 165c, 180c



This is a generic representation of a product family. Configurations may vary.

Figure 1 Exploded View

Battery Assembly	
Battery NiCad, 2.9 Amp Hour.....	661-0013
Case, Battery (replaced by 076-1539)	076-0590
Case, Battery, NiCad.....	076-1539
Power Adapter.....	699-0517
Power Adapter, 17 W	922-0043
Power Adapter, 17 W, Australia.....	X922-0043
Power Adapter, 17 W, European	Z922-0043
Power Adapter, 17 W, United Kingdom	B922-0043
Power Adapter, Australian	X922-0376
Power Adapter, European.....	Z922-0376
Power Adapter, U.S./ Japan.....	922-0376
Power Adapter, United Kingdom.....	B922-0376
Case Assembly	
Battery Door	815-1240
Brightness Actuator (145B/165/165c)	815-1248
Brightness Actuator, Long (180c).....	815-1305
Case, Bottom with Labels (165, 165c, 180c).....	076-0872
Case, Bottom with Label (145B).....	076-0684
Case Top (145B)	630-5017
Case Top (165)	922-0048
Case Top (165c/180c).....	922-0717
Contrast Actuator (145B/165/165c).....	815-1247
Elevation Foot, Left	815-1278
Elevation Foot, Right.....	815-1237
Elevation Foot, Spring.....	805-0400
Elevation Foot, Washer	815-1266
I/O Door.....	815-1233
Plug, Rubber Display.....	875-0112
Rubber Foot	815-1236
Screw Set.....	076-0556
Clutch Assembly	
Center Clutch Cover	815-1230
Center Clutch Cover.....	922-0029
Clutch, Right Assembly	699-0497
Clutch, Left Assembly.....	699-0498
End Clutch Cover	815-1231
Converter, Inverter, and Interconnect Boards	
Converter, DC/DC (165c)	922-0375
Converter, DC/DC (180c)	922-0379
Interconnect Board (145B)	661-0724
Interconnect Board (165).....	661-0750
Interconnect Board (165c).....	661-0764

Interconnect Board (180c).....	661-0685
Inverter (145B) (Use with 661-1020 display).....	922-0911
Inverter, FSTN, Blue, Rev. C (145B/165).....	922-0025
Inverter Shield (145B/165) (Pkg. of 5).....	076-0588
Display Assembly	
Bezel, Display Shroud (165).....	922-1108
Bezel, Display Shroud (165c).....	922-0377
Bezel, Display Shroud (180c).....	922-0414
Display Bezel (145B).....	922-0487
Display, Active Matrix, Int'l Only (180c).....	661-0711
Display, Flat Panel (145B) (requires inverter 922-0911).....	661-1020
Display, FSTN, Color (165c)	661-0752
Display, FSTN, Rev. C (145B/165)	661-0745
EMI Shield (165c).....	922-0449
Housing Display (145B/165).....	922-0044
Housing Display (165c)	922-0381
Housing Display (180c)	922-0415
Insulator Inverter DC to AC (Pkg. of 5) (180c)	922-0422
Inverter, DC to AC (165c).....	922-0374
Inverter, DC to AC (180c).....	922-0378
Inverter Shield (Pkg. of 5) (165c/180c).....	076-0588
Inverter Shield (Pkg. of 5) (180c)	922-0418
Kit, Bulb, Rev. A Display, (145B) (for 661-0706).....	076-0681
Kit, Bulb, Rev. C Display, (165) (for 661-0745).....	076-0682
Kit, PowerBook FSTN Display Replacement	661-8745
Shield, Display EMI (145B/165)	805-0138
Shield, Display EMI (145B/165)	922-0543
Shield, Display EMI (180c).....	922-0417
Display Cables	
Cable, Converter to Inverter (165c).....	922-0566
Cable, Converter to Inverter (180c).....	922-0412
Cable, Display (165c)	922-0373
Cable, Display (180c)	922-0380
Cable, Flex Assembly, FSTN Display (145B/165).....	922-0820
Cable, FSTN Flex, Rev. A/C (replaced by (922-0820)	936-0108
Cable, Inverter (145B/165)	936-0106
Shim, Display Cable (Pkg. of 5) (145B).....	076-8545
Drive Assembly	
1.44 MB Floppy Disk Drive, 19 mm-high.....	661-1651
Cable, Flex, Hard Drive (165/165c/180c)	922-0027
Cable Flex, Hard Drive (145B)	630-0534
Cable, Flex 19 mm-high Floppy Drive	821-0655
HDA, 20 MB, 2.5" SCSI (145B)	661-1622

HDA, 40 MB, 2.5" SCSI (145B/165)	661-1630
HDA, 80 MB, 2.5" SCSI (165/165c/180c).....	661-0796
HDA, 80 MB, 2.5", SCSI (145B)	661-1643
HDA, 120 MB, 2.5" SCSI (180c).....	661-0772
HDA, 160 MB, 2.5" SCSI (165/165c/180c).....	661-0060
Retainer, 17 mm Drive	922-0009
Retainer, 17 mm Drive (replaced by 922-0009)	805-0412
Retainer, 17 mm Drive (180c) (replaced by 922-0009)	805-0412
Retainer, 19 mm Drive	922-0006
Retainer, 19 mm Drive (replaced by 922-0006)	805-0414
Retainer, 19 mm Drive (180c) (replaced by 922-0006)	805-0414
Expansion Boards	
Modem Board, 2400 Baud, International.....	661-1620
Modem, Express, 14.4 Baud, Domestic (165).....	661-0786
Modem, Express, 14.4K Baud, Int'l. Only.....	661-8013
Modem, Internal Fax/Data, 2400 Baud, Domestic, PB.....	661-1621
Modem Port Cover	815-0578
PSRAM, Expansion Card, 2 MB (145B).....	661-0715
PSRAM, Exp. Card, 4 MB, 100 ns (replaced by 661-0790)	661-0714
PSRAM, Expansion Card, 4 MB, 85 ns.....	661-0790
Screws, Modem (145B/165)	076-0575
Keyboard	
Key Cap Set	076-0450
Keyboard, British.....	B661-0712
Keyboard, French.....	F661-0712
Keyboard, French Canadian.....	C661-0712
Keyboard, German	D661-0712
Keyboard, H-Grey	D661-1680
Keyboard, International	Z661-0712
Keyboard, Italian	T661-0712
Keyboard, Japanese.....	J661-0712
Keyboard, Spanish.....	E661-0712
Keyboard, Swedish	S661-0712
Keyboard, US	661-0712
Motherboard/Daughterboard	
Cousin Card (165c/180c)	661-0755
Gasket, Sound, Motherboard (Pkg. of 10) (145B).....	922-0014
Insulator, Motherboard (145B)	725-0009
Insulator, Motherboard (Pkg. of 10) (165/165c/180c)	922-0045
Kit, Heatsinks, Daughterboard (165/165c/180c)	076-0069
Logic Board, Daughterboard (145B)	661-1715
Logic Board, Daughterboard (165).....	661-1016
Logic Board, Daughterboard (165c/180c)	661-0751

Logic Board, Daughterboard (180c)	661-0684
Logic Board, Motherboard (145B)	661-0708
Logic Board, Motherboard (165)	661-0746
Logic Board, Motherboard (165c, 180c).....	661-0765
Sound Jack Cover (165/165c/180c)	922-0046
Sound Jack Insulator, Motherboard (165, 165c, 180c)	922-0591
Spacer, Motherboard (Pkg. of 10) (145B)	922-0023
Thermistor Assy, Flex Circuit	630-5241
Trackball Assembly	
Ball, Trackball	949-0362
Retainer, Trackball	949-0363
Trackball Assembly	661-0730
Miscellaneous	
Accessory Kit, 145B	601-0322
Backlight Assembly	949-0370
Cable, HDI-30, SCSI Adapter.....	590-0718
Cable, HDI-30, SCSI System	590-0717
External Battery Charger.....	076-0567
Insulator, Heatsink, Floppy Drive (Pkg. of 10).....	922-0518
Inductor, Insulator.....	922-0201
Microphone, Cable Assy, w/ clip granite	699-5098
Modem, Internal, Send/Rec Fax, 2400, US, PB.....	661-0873
Power Adapter (replaced by 922-0376)	699-0517
Screw Kit	076-0556
Screw Set (165c).....	076-0556
Svc. Pkg., HDA 2.5"	602-0307
Svc. Pkg., HDA 3.5", 1" High Drives w/o Carriers	602-0308
Tool, Hex Nut Driver, 3/16.....	077-0678
Tool, Take Apart, Logic Board.....	077-0364
Tool, Torx Driver, t-10	077-0676
Tool, Torx Driver, t-8	077-0677
Upgrade Kit, 40 MB HDA	652-0040
Upgrade Kit, 40 MB HDA w/2 MB PSRAM.....	652-0041
Upgrade Kit, 80 MB HDA w/2 MB PSRAM.....	652-0081
Upgrade Kit, 80 MB HDA	652-0080
Video Cable, External (165c, 180c).....	922-0831

Specifications – PowerBook 145B, 165, 165c, 180c

Processor	PowerBook (145B): Motorola 68030 microprocessor; 25 MHz PowerBook (165, 165c, 180c): Motorola 68030 microprocessor; 33 MHz Coprocessor (165c/180c): Motorola 68882 floating point Addressing: 32-bit internal registers, address bus and data bus
Memory	RAM (145B): 4 MB expandable to 8 MB (by installing 4 MB expansion card) RAM (165, 165c, 180c): 4 MB expandable to 14 MB (using third-party expansion cards) ROM: 1 MB (165, 165c, 180c); 1 MB expandable to 4 (145B) PRAM: 256 bytes of parameter memory VRAM: 256K of static video display memory (145B); 128K of static video display memory (165); 512K of video RAM supports internal display and external monitor (165c, 180c) Clock/Calendar: Custom chip with long-life lithium battery
Disk Storage	Floppy Drive: Internal 19 mm high, 1.4 MB Apple SuperDrive Hard Drive: 2.5 in. (many capacities)
I/O Interfaces	Floppy Drive: DB-19 serial port for connection external floppy drives (145B, 165) SCSI: HDI-30 SCSI port with 1.5 MB.sec. transfer rate; supports up to five external SCSI port devices; does not provide termination power; connection to another computer requires HDI-30 SCSI system cable ADB: ADB port (max. of three ADB devices); 200 mA max. current draw for all ADB devices Serial: Two RS-422 serial ports; mini DIN-8 connectors Sound: Monoaural sound-in port; stereo sound-out jack for headphone or external audio amplifier Video: Video-out port (165, 165c, 180c); 8-bit, 256 color video output; supports Macintosh monitors up to 16-in. color and VGA monitors (165) or most Macintosh monitors, VGA, and SVGA monitors (165c, 180c); micro DB-15 connector
I/O Devices	Keyboard: Built-in standard Apple keyboard; 63 keys domestic; 64 keys ISO; two-level tilt adjustment Trackball: 30 mm diameter, dual button; ADB interface Microphone: Electret, omnidirectional; output voltage of 4 mV, peak-to-peak

Sound and Video	Video Display (145B, 165): 10-in diagonal screen; flat-panel, film-compensated supertwist nematic (FSTN) liquid crystal display; CCFL on-demand backlight; 640 lines x 400 pixels (145B); 16 shades of grey (145B, 165) Video Display (165c): 9-in diagonal screen; flat-panel, color, FSTN liquid crystal display; CCFL on-demand backlight; 640 lines by 400 pixels; 8 bit; 256 colors (165c) Video Display (180c): 8.4-in diagonal screen; flat-panel, color, active-matrix, liquid crystal display; CCFL on-demand backlight; 640 by 480 pixels; 8 bit; 256 colors Sound Generator: Apple sound chip provides 4-voice, 8-bit sound; 8-bit sound input, sampled at 11 or 22 kHz
Electrical	Main Battery: NiCad 2.5 A/hr; provides 2-3 hours of usage before recharging; recharge time 3 hours; 500 power cycles of capacity (145B, 165); provides 1.5-2 hours of usage before recharging (165c/180c) PRAM battery: 3 V lithium Power Adapter: 110-240 VAC line voltage; 24 W; 50-60 Hz; US, Japanese, United Kingdom, Australian, and European versions
Physical	Height: 2.25 in (145B, 165) 2.29 in. (165) 2.34 in. (180c) Width: 11.25 in. Depth: 9.3 in. Weight (with battery): 6.8 lb. (145B, 165) 7.0 lb. (165c) 7.1 lb. (180c)
Other	Fax/Data Modem: Internal 2400-baud modem with fax send at 9600 baud (includes fax send software); 300/1200/2400 bps transmission rates; error correction and data compression: MNP 4, 5 and V.42, V.42bis Express Modem: Internal 14,400-baud modem with fax send/receive at 9600 baud; 300-14,400 bps data transmission rates; 2400/4800/7200/9600 bps transmission rates; full duplex operation; asynchronous or framed modes; error correction; V.42 compliance (MNP 2-4); data compression: V.42bis (4 to 1 compression) and MNP-5 (2-to-1 compression); requires 300K of system RAM SCSI Adapter: Enables connection between PowerBook computer and desktop Macintosh (PowerBook appears as a hard drive on the desktop)

PowerBook Basics – PowerBook 145B, 165, 165c, 180c

The PowerBook family includes four displays—an active matrix and three FSTN displays. Each of these displays requires a compatible inverter and display cable; the inverters, display cables and displays are not interchangeable. Before ordering a replacement display, display cable, or inverter, refer to the display matrix below.

PowerBook Displays	145B	165	165c	180c
FSTN monochrome, backlit, passive-matrix, liquid crystal display	661-0745 and 661-1020	661-0745		
FSTN color, backlit, passive-matrix, liquid crystal display			661-0752	
Active-matrix color, backlit, liquid crystal display				661-0686
Inverter	For display 661-0745, use inverter 922-0911; for display 661-1020, use inverter 922-0025	922-0025	922-0374	922-0378
Converter			922-0375	922-0379
Display Cable	922-0820	922-0820	922-0373	922-0380
Inverter Cable	936-0106	936-0106		
Converter-to-Inverter Cable			922-0566	922-0412

Symptom/Cure – PowerBook 145B, 165, 165c, 180c

Startup Problems	Solutions
RAM failure occurs (eight-tone error chord sequence sounds after startup chord)	<ol style="list-style-type: none">1. Startup from Disk Tools disk and do a clean install of system software.2. Reseat RAM expansion card and check connection.3. Replace RAM expansion card.4. Replace daughterboard.5. Replace motherboard.
Computer powers on but has no startup chime and displays a grey screen or image of last open window without booting	<ol style="list-style-type: none">1. Reseat daughterboard.2. Replace daughterboard.
Hardware failure occurs (four-tone error chord sequence sounds after startup chord)	<ol style="list-style-type: none">1. Restart computer with Disk Tools disk.2. Disconnect hard drive data cable and restart computer. If startup sequence is normal, reconnect cable and retest.3. Replace hard drive.4. Disconnect floppy drive cable and restart computer. If startup sequence is normal, reconnect cable and retest.5. Replace floppy drive.6. Replace motherboard.
Power Problems	Solutions
Screen is dark; computer doesn't respond	<ol style="list-style-type: none">1. Reset power manager.
Screen is blank; computer doesn't respond	<ol style="list-style-type: none">1. Restart computer.2. Reset the power manager.3. Try known-good, charged main battery.4. Check all interconnect board, daughterboard, and motherboard connections.5. Replace keyboard.6. Replace interconnect board.7. Replace daughterboard.8. Replace motherboard.
After you remove main battery, some control panel settings are different	<ol style="list-style-type: none">1. Check cables.2. Replace interconnect board.3. Replace daughterboard.4. Replace motherboard.5. Reset power manager.

Power adapter is plugged in, but battery DA does not indicate charger is connected	1. This is normal for fully charged battery. 2. Check power adapter connection. 3. Reset power manager. 4. Try known-good, charged main battery. 5. Try known-good power adapter. 6. Check battery thermistor cable connection. 7. Replace motherboard.
Low-power warning appears	1. Recharge battery or attach power adapter. 2. Verify that peripherals are low-power. 3. Remove external devices or connect power adapter. 4. Try known-good, charged main battery. 5. Try known-good power adapter. 6. Replace motherboard.
Computer runs when plugged into wall outlet but not on battery power; battery voltage is within tolerance	1. Reset power manager. 2. Check AC adapter for damage on tip. 3. Reseat battery to make sure it is meeting with contacts on motherboard. 4. Replace motherboard. 5. Return computer to Apple.
Computer powers on, then powers off within a few seconds	1. Plug in power adapter and restart. 2. Try known good charged battery.
Video Problems	Solutions
Row or partial row of pixels never comes on or is always on	1. Check cables. 2. Replace display cable. 3. Replace inverter board. 4. Replace display (145B/165/165c).
Thin white line is always on at middle of screen (145B/165/165c)	1. For FSTN screens, a thin white line is normal.
Shadows or ghosting appears on display (145B/165/165c)	1. This is normal for passive matrix displays.

-
- 
- | | |
|--|--|
| Display is very light or totally white | <ol style="list-style-type: none">1. Adjust screen contrast and brightness.2. Check display cable, converter board, inverter board, interconnect board, daughterboard, and motherboard connections.3. Replace converter board.4. Replace inverter board.5. Replace interconnect board.6. Replace display cable.7. Replace display (145B/165/165c).8. Replace daughterboard.9. Replace motherboard. |
| No display, but computer appears to operate correctly | <ol style="list-style-type: none">1. Press any key to wake computer from system sleep.2. Adjust screen contrast and brightness.3. Check display cable, converter board, inverter board, interconnect board, daughterboard, and motherboard connections.4. Connect power adapter.5. Replace converter board.6. Replace inverter board.7. Replace interconnect board.8. Replace converter-to-inverter cable.9. Replace display cable.10. Replace display (145B/165/165c).11. Replace daughterboard.12. Replace motherboard. |
| Rainbow colors visible from extreme viewing angles (145B/165/165c) | <ol style="list-style-type: none">1. Such colors are normal for FSTN screens. |
| Pixel is always white or always black (180c) | <ol style="list-style-type: none">1. In general, the active matrix display will have some pixels out. If the number of irregularities on a display appears excessive, contact Apple for more information. |
| Screen stopped working or dimmed but is fine now (145B/165/165c) | <ol style="list-style-type: none">1. If temperature is under 5 or over 40 degrees centigrade, this reaction is normal for FSTN screens. |

- Backlight doesn't operate
1. Verify that cables are not pinched or severed.
 2. Check display cable, inverter board, interconnect board, daughterboard, and motherboard connections.
 3. Replace converter board.
 4. Replace inverter board.
 5. Replace converter-to-inverter cable.
 6. Replace interconnect board.
 7. Replace display cable.
 8. Replace bulb.
 9. Replace display (145B/165/165c).
 10. Replace daughterboard.
 11. Replace motherboard.

Floppy Drive Problems

Solutions

Audio and video present, but internal floppy drive does not operate

1. Try known-good floppy disk.
2. Try booting from Disk Tools disk.
3. Check floppy drive cable connection.
4. Replace floppy drive cable.
5. Replace floppy drive.
6. Replace daughterboard.
7. Replace motherboard.

Disk ejects while booting; display shows Mac icon with blinking X

1. Try known-good system disk.
2. Verify that trackball or mouse button is not stuck.
3. Check floppy drive cable connection.
4. Replace floppy drive cable.
5. Replace floppy drive.
6. Replace motherboard.

Disk does not eject

1. Switch off system and hold mouse button down while you switch system on.
2. Insert straightened paper clip into hole below drive.
3. Check floppy drive cable connection.
4. Replace floppy drive cable
5. Replace floppy drive.
6. Replace daughterboard.
7. Replace motherboard.

Disk initialization fails

1. Try known-good floppy disk.
2. Restart with Disk Tools disk.
3. Restart with extensions off.
4. Install inverter shield (if absent).
5. Check floppy drive cable connection.
6. Replace floppy drive cable.
7. Replace floppy drive.

-
- Read/write/copy error
1. Try known-good floppy disk.
 2. Restart with extensions off.
 3. Install inverter shield if absent.
 4. Check floppy drive cable.
 5. Replace floppy drive cable.
 6. Replace floppy drive.

Hard Drive Problems

Solutions

Internal hard drive does not operate

1. Disconnect external SCSI devices.
2. Check internal hard drive data cable connection.
3. Use Disk First Aid to repair drive.
4. Use HD SC Setup to reinitialize drive.
5. Replace internal hard drive data cable.
6. Replace internal hard drive.
7. Replace motherboard.

Peripheral Problems

Solutions

After you connect external SCSI device, computer does not boot

1. Switch on external SCSI device before starting computer.
2. Check cable connections.
3. Verify that standard Apple terminator terminates SCSI chain at beginning and end.
4. Verify that SCSI select switch setting on external device is unique.
5. Verify operation of internal hard drive.
6. Try known-good external SCSI device.
7. Try known good SCSI cables/terminators.
8. Replace motherboard.

Cursor does not move when you are using trackball

1. Restart computer with extensions off.
2. Clean trackball rollers and bearings.
3. Boot from Disk Tools disk.
4. Check cables.
5. Check interconnect board, daughterboard, and motherboard connections.
6. Try low-power mouse. If cursor moves, replace trackball or keyboard.
7. Replace interconnect board.
8. Replace daughterboard.
9. Replace motherboard.

-
- | | |
|---|---|
| Cursor intermittently does not move or moves erratically | <ol style="list-style-type: none">1. Restart computer.2. Clean ball and rollers of trackball.3. Check cables.4. If connected through external keyboard, connect directly to PowerBook.5. Replace trackball.6. Replace keyboard.7. Replace interconnect board.8. Replace motherboard. |
| Cursor moves, but clicking trackball button has no effect | <ol style="list-style-type: none">1. Restart computer.2. Check interconnect board, daughterboard, and motherboard connections.3. Replace trackball.4. Replace keyboard.5. Replace interconnect board.6. Replace daughterboard.7. Replace motherboard. |
| Cursor does not move when you are using mouse | <ol style="list-style-type: none">1. Check mouse connection to ADB port.2. Restart computer.3. Clean mouse ball and inside mouse.4. Replace mouse.5. Replace motherboard. |
| No response to any key on keyboard | <ol style="list-style-type: none">1. Reset power manager.2. Boot from Disk Tools disk.3. Check connections of keyboard to interconnect board to and interconnect board to daughterboard.4. Replace keyboard.5. Replace interconnect board.6. Replace daughterboard. |
| Known-good direct-connect printer does not print | <ol style="list-style-type: none">1. Verify that System is 7.0 or later.2. Verify that Chooser and control panel settings are correct.3. Check cables.4. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys.5. Replace printer interface cable.6. Try known-good printer.7. Replace daughterboard.8. Replace motherboard. |

-
- | | |
|--|--|
| Known-good network printer does not print | <ol style="list-style-type: none">1. Verify that System is 7.0.1 or later.2. Verify that Chooser and control panel settings are correct and AppleTalk is active.3. Check cables.4. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys.5. Boot with extensions off and then try to print.6. Replace printer interface cable.7. Connect printer directly. If printer works, troubleshoot network.8. Replace daughterboard.9. Replace motherboard. |
| Device connected to external modem port doesn't work | <ol style="list-style-type: none">1. Verify that External Modem is selected in CDEV.2. Verify that System is 7.0.1 or later.3. Check cables.4. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys.5. Test device with known-good computer.6. Replace daughterboard.7. Replace motherboard. |
| I/O devices are unrecognized or garbage is transmitted or received | <ol style="list-style-type: none">1. Verify that System is 7.0.1 or later.2. Check cables.3. Verify that SCSI device has standard Apple terminator.4. Verify that SCSI select switch setting on external device is unique.5. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys.6. Boot with extensions off if I/O device does not require extensions.7. Test device with known-good computer.8. Replace daughterboard.9. Replace motherboard. |
| Cursor moves too slowly after connecting mouse. | <ol style="list-style-type: none">1. Restart and make sure mouse is plugged in before computer is turned on. |

Internal Modem Problems

Internal modem options do not appear in CDEV

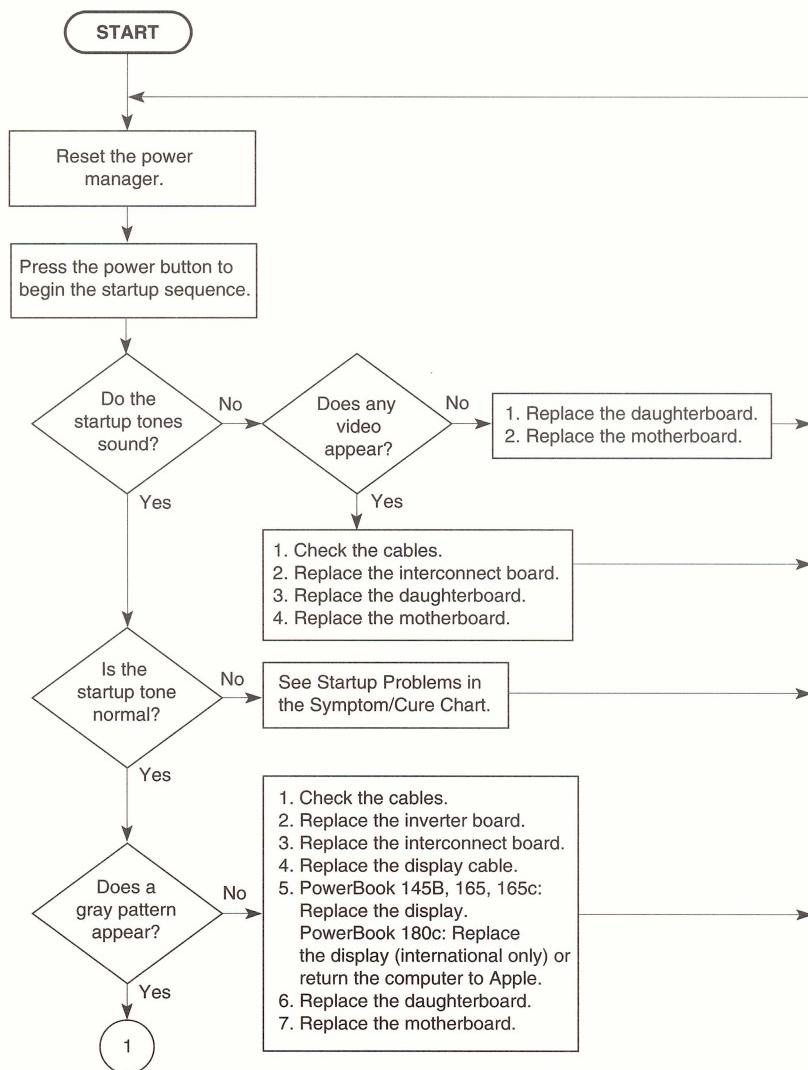
Solutions

1. Verify that System is 7.0.1 or later.
2. Remove and reseat modem card.
3. Reinstall modem software.
4. Replace modem card.
5. Replace motherboard.

-
- | | |
|--|---|
| Modem does not respond properly to AT command set instructions | <ol style="list-style-type: none">1. Verify that baud rate and data format settings of communications application are compatible with internal modem and remote modem.2. Check phone cord connection and operation.3. Reinstall modem software.4. Verify that system software is 7.0.1 or later.5. Remove and reseat modem card.6. Replace modem card |
| Strange mix of characters appears on screen | <ol style="list-style-type: none">1. Verify that baud rate and data format settings of communication application are compatible with internal modem and remote modem.2. Check phone cord connection and operation.3. Remove and reseat modem card.4. Use AT commands to turn echo off (ATE0)5. Verify that System is 7.0.1 or later.6. Replace modem card.7. Replace daughterboard.8. Replace motherboard. |
| Modem interferes with system sound | <ol style="list-style-type: none">1. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys.2. Remove and reseat modem card.3. Replace modem board.4. Replace interconnect card.5. Replace motherboard. |
| Modem does not respond to incoming call | <ol style="list-style-type: none">1. If computer is in sleep mode, verify that Wake On Ring option in CDEV is selected.2. Verify that Fax Terminal preferences are set to Answer Calls.3. Check phone cord connection and operation.4. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys.5. Replace modem card.6. Replace motherboard. |
| Modem has no sound output | <ol style="list-style-type: none">1. Verify that control panel setting is above 0.2. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys.3. Replace modem card.4. Replace interconnect card.5. Replace speaker.6. Replace motherboard. |

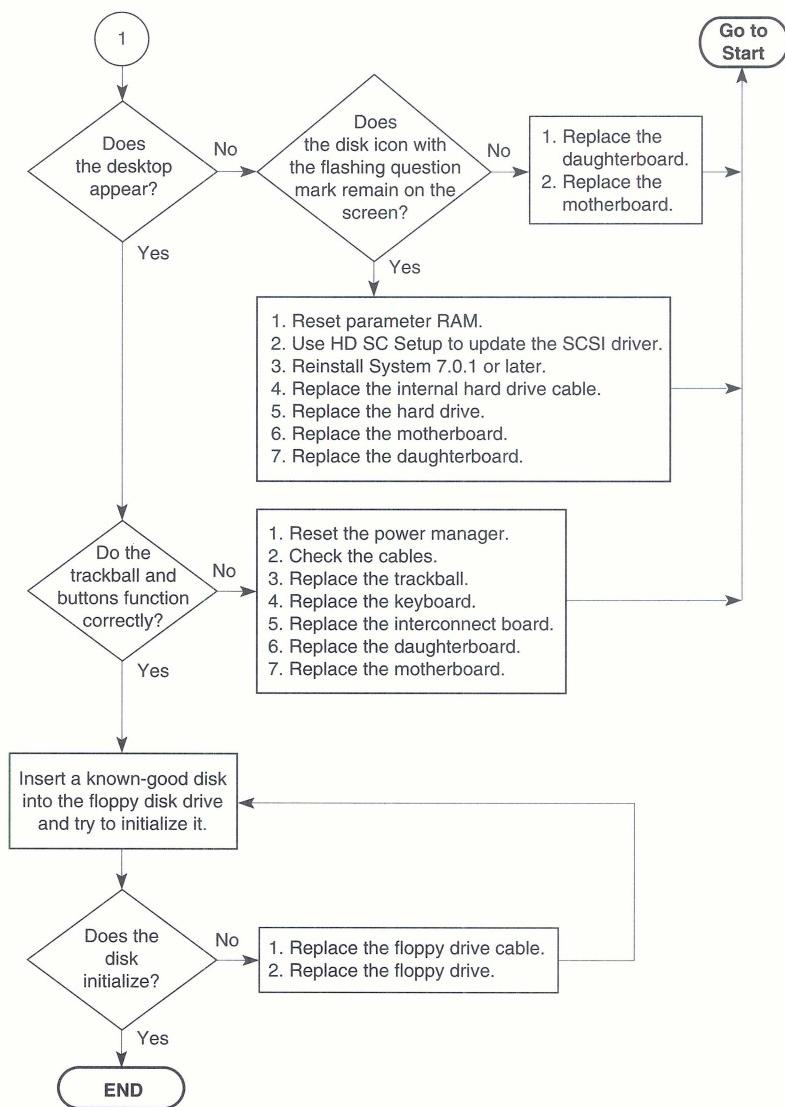
Miscellaneous Problems	Solutions
Modem connects but does not communicate with remote modem	<ol style="list-style-type: none"> 1. Verify that remote modem needs error correction (error correction is internal modem default). 2. Type AT&Q0 to disable error correction. 3. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys. 4. Try known-good modem of same model and type. 5. Replace modem.
Screen goes blank and computer shuts down every few minutes	<ol style="list-style-type: none"> 1. Adjust sleep delays in control panel or connect power adapter. 2. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys. 3. Check sleep settings. 4. Boot with extensions off.
Application seems to run slower after few seconds	<ol style="list-style-type: none"> 1. Disable System Rest/Processor Cycling. (See owner's manual.) 2. Connect power adapter. 3. Disable processor cycling.
Hard drive is slow to respond, or screen goes blank too often	<ol style="list-style-type: none"> 1. Adjust sleep delays in control panel or connect power adapter. 2. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys. 3. Boot with extensions off. 4. Check sleep settings.
No sound from speaker	<ol style="list-style-type: none"> 1. Verify that Volume control panel setting is above 0. 2. Verify that no external speaker is plugged in. 3. Reset PRAM by restarting computer and holding down the Command, Option, P, and R keys. 4. Boot with extensions off. 5. Check connections of speaker to interconnect board, interconnect board to daughterboard, and daughterboard to motherboard. 6. Replace interconnect board. 7. Replace speaker. 8. Replace daughterboard. 9. Replace motherboard.

Troubleshooting Flowchart – PowerBook 145B, 165, 165c, 180c



1
3

Flowchart 1 Startup Problems



Flowchart 2 Startup Problems

Additional Procedures

Modem Card Installation

- ▲ **Caution** The PowerBook 145B/165/165c/180c contains CMOS devices that are very susceptible to ESD damage. To prevent ESD damage, wear a grounding wriststrap. Review the ESD precautions in Introduction and Safety.
- ▲ **Caution** If you install a third-party modem card, make sure that it does not cover any of the heat sinks on the daughterboard or over the floppy drive.

The modem card is optional on the PowerBook 145B, 165, 165c, 180c.

1. Remove the main battery, I/O door, and top cover.
2. Pinch the release tabs and push out the modem port cover.
3. Connect the modem card connector to connector JB on the motherboard (Figure 2).
4. Install the two mounting screws.
5. Affix the FCC modem label to the inside of the I/O door. Align the label with the modem port.
6. Affix the DOC label to the inside of the I/O door. Align the label with the HD-30 SCSI port.

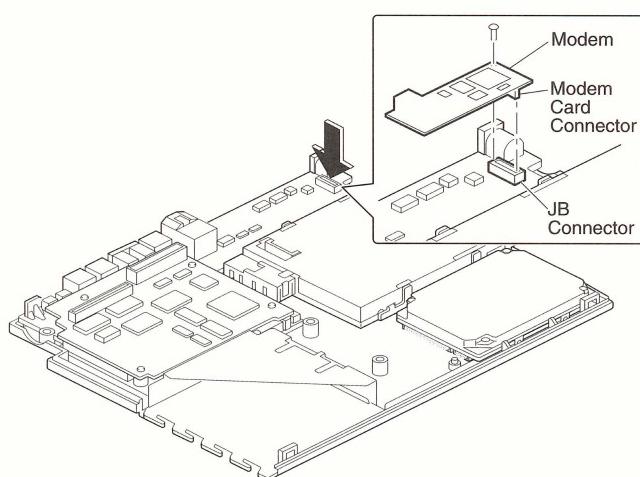


Figure 2 Modem Card

RAM Expansion Card Installation

- ▲ **Caution** Handle the RAM expansion card by the edges only. Do not touch any components on the card. When installing the RAM expansion card, press down on the edge of the card directly above the connector. Be careful not to apply pressure to any components or you may permanently damage the card.
- ▲ **Caution** An incorrectly installed RAM card could damage the daughterboard. Note that the expansion connector on the motherboard and the RAM card are keyed for proper installation. Do not force the card into the connector, thereby defeating the key.

1. Remove the main battery.
2. Remove the I/O door.
3. Remove the top case.
4. Connect the RAM expansion card to connector J1 on the daughterboard. (Figure 3).

To verify that the upgrade is successful, check the Total Memory message (for systems with virtual memory switched off) or the Built-in Memory message (for systems with the virtual memory switched on). The memory size should be 4 MB of soldered RAM plus the RAM on the expansion board. If the memory size is incorrect, replace the RAM expansion card. If the memory size is still incorrect, send the computer to Apple.

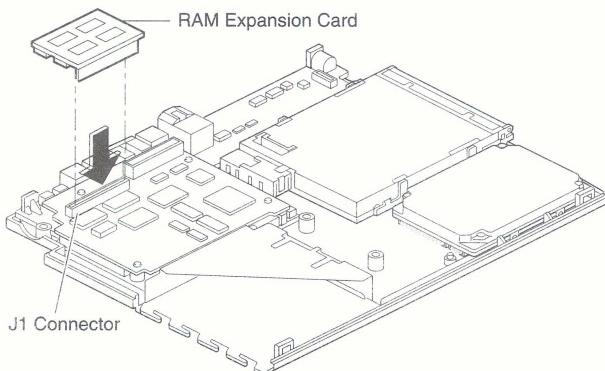


Figure 3 RAM Expansion Card

Shim Installation – PowerBook 165

Some PowerBook 165 displays may flicker, intermittently go black, or display two horizontal black lines. If squeezing the right side of the display bezel causes the condition to improve or to worsen, install a shim on the display cable. The shim improves the connection between the connector fingers and the cable contacts.

Do not install a shim on a display cable stamped with part number 936-0108.

▲ Caution The display cable is fragile and should be handled with care.

1. Remove the main battery and display bezel.
2. Cover the keyboard with a clean cloth or sheet of paper (Figure 4).
3. Using a T-8 torx driver, remove the four display mounting screws.
4. Remove the display from the housing and EMI shield (Figure 4).
5. Place the display face-down on the keyboard.
6. Lift the locking tab on the display connector and disconnect the display cable (Figure 4).
7. Remove the clear shim from its paper backing. Make sure that the shim is not wrinkled and that it is flush with the edges of the cable. The shim should not cover the connector traces.
8. Turn back the end of the display cable and press the shim onto the back (the nonconductive side) of the display cable connector (Figure 4).

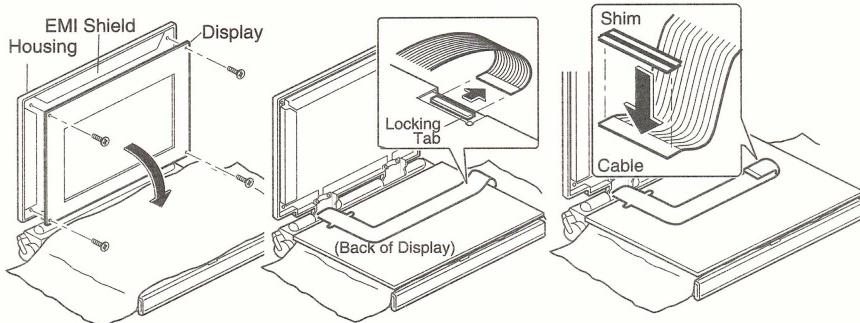


Figure 4 PowerBook 165 Shim Installation

SCSI Termination

The PowerBook 145B/165/165c/180c computers do not provide SCSI termination on the logic board. You must terminate the beginning and the end of the SCSI chain. Use the standard Apple terminator.

Add one terminator to a single external SCSI device, or add one terminator to the first device and another to the last when there are multiple devices.

Battery Handling

▲ Warning **The main battery contains toxic materials. Send undamaged, dead batteries to Apple for recycling—do not discard dead batteries with other waste. If the battery is damaged, do not return it to Apple. Dispose of damaged batteries according to local ordinances.**

Follow these guidelines for properly handling a NiCad battery:

- Handle the battery carefully. Do not drop, puncture, disassemble, mutilate, or incinerate the battery.
- Fully charge a replacement battery before using it; Apple ships batteries in a partially charged state.
- Do not leave the battery in the computer for longer than two weeks without plugging in the power adapter.
- Completely discharge and recharge the battery once a month.
- Store the battery in the protective battery case. Refer to the Parts List for additional battery cases.
- Do not short-circuit the battery terminals.
- Keep the battery in a cool dark place; do not store for longer than 6 months without recharging.

Rev. C Display Bulb for PowerBook 145B/165

1. Remove the main battery.
2. Remove the display bezel.
3. Remove the display.
4. Place the display face-down on a soft workbench pad.
5. Remove the two cables from their channels.
6. Turn over the display.
7. Remove the remaining length of the cables from the channels.
8. Using a #1 cross-tip screwdriver, remove the four self-threading screws.
9. Remove the plastic display bulb cover.
10. Remove the display bulb.

When replacing the new bulb, make sure the cables are in the same position as the previous bulb cables.

Motherboard and Daughterboard Diagrams

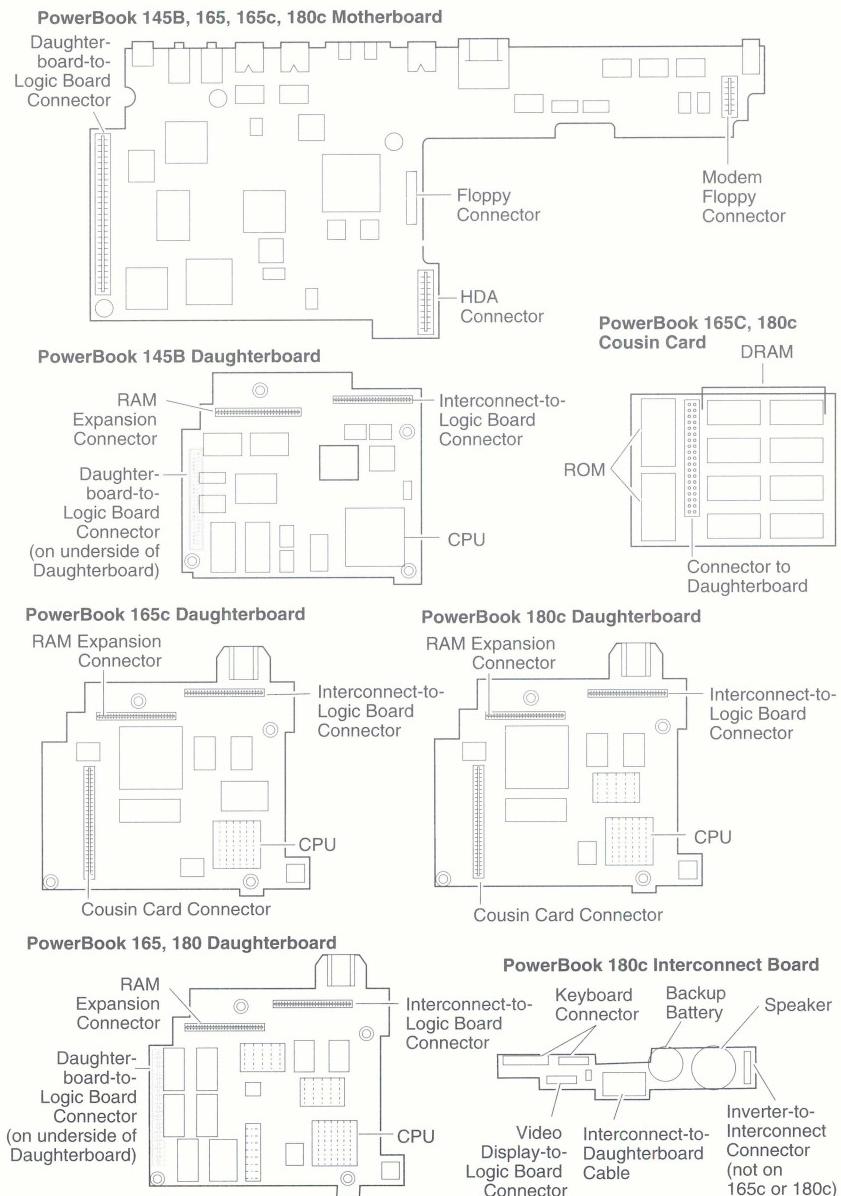
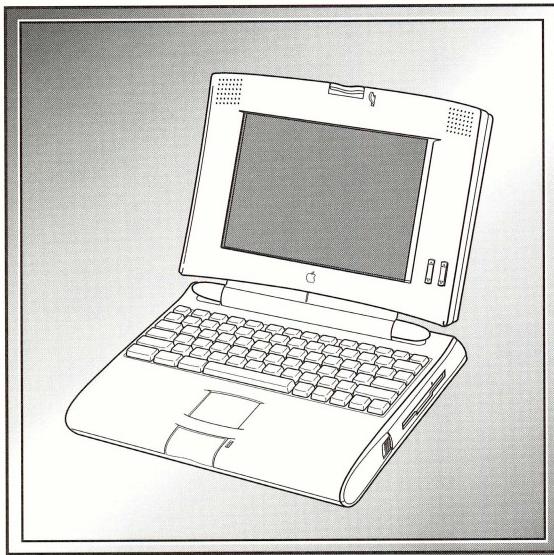


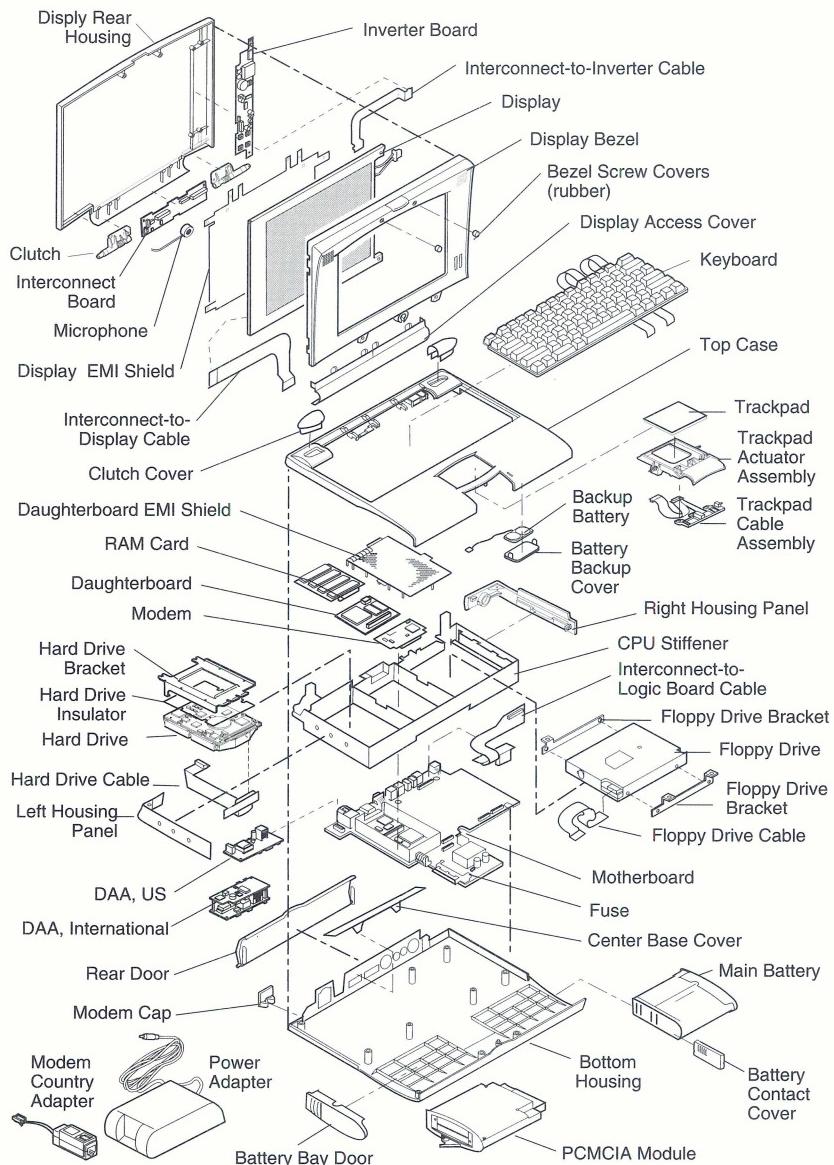
Figure 5 PowerBook 145B, 165, 165c, and 180c Logic Boards

PowerBook 520, 520c, 540, 540c



Illustrated Parts List	278
Specifications	281
Troubleshooting Flowchart	283
Symptom/Cure Chart	285
Additional Procedures	293
Logic Board Diagrams	295

Illustrated Parts List – PowerBook 520, 520c, 540, 540c



This is a generic representation of a product family. Configurations may vary.

Figure 1 PowerBook 520, 520c, 540, and 540c Exploded View

Battery	
Battery, Backup with Cable .....	.922-0786
Battery Bay Door (Pkg. of 5) .....	.922-0821
Battery Pack with Door.....	.661-0055
Cover, Backup Battery (Pkg. of 10).....	.922-0787
Plug, AC Adapter.....	.922-0823
Power Adapter, 40 W, US .....	.922-0825
Case	
Cover, Base, Center (Pkg. of 10) .....	.922-0788
CPU Stiffener with Feet.....	.922-0910
Door, Rear (Pkg. of 10) .....	.922-0790
Kit, Top/Bottom Housing with Labels .....	.076-0274
Kit, Housing Panels, Left and Right.....	.076-0265
Clutch Assembly	
Clutch Covers (Pkg. of 10) .....	.922-0771
Kit, Clutches, Left and Right.....	.076-0299
Display	
Access Cover, Display (Pkg. of 10).....	.922-0789
Display Panel, Dual Scan Color (PB 520c) .....	.661-0062
Display Panel, FSTN Mono (PB 520).....	.661-0064
Display Panel, TFT Color (PB 540c) .....	.661-0056
Display Panel, TFT Mono (PB 540).....	.661-0063
Inverter Board.....	.922-0774
Kit, Bezel, Display (includes Display Access Cover and Rear Housing) .....	.076-0464
Microphone Assembly .....	.922-0783
Shield, Display, EMI .....	.922-0781
Expansion Cards	
Cap, Modem (Pkg. of 10) .....	.922-0824
Country Adapter, US .....	.922-0897
DAA, PCB, Int'l .....	.922-0939
DAA, US .....	.922-0997
Modem PCB, US .....	.661-0107
Modem PCB, Int'l .....	.661-0106
PCMCIA Adapter.....	.661-0137
RAM Expansion, 8 MB .....	.661-0058
Floppy Drive	
Cable, Floppy Drive-to-Logic Board (Pkg. of 10).....	.922-0780
Drive, Floppy, 1.4 MB.....	.661-0061
Kit, Floppy Drive Brackets (5 Sets) .....	.076-0462

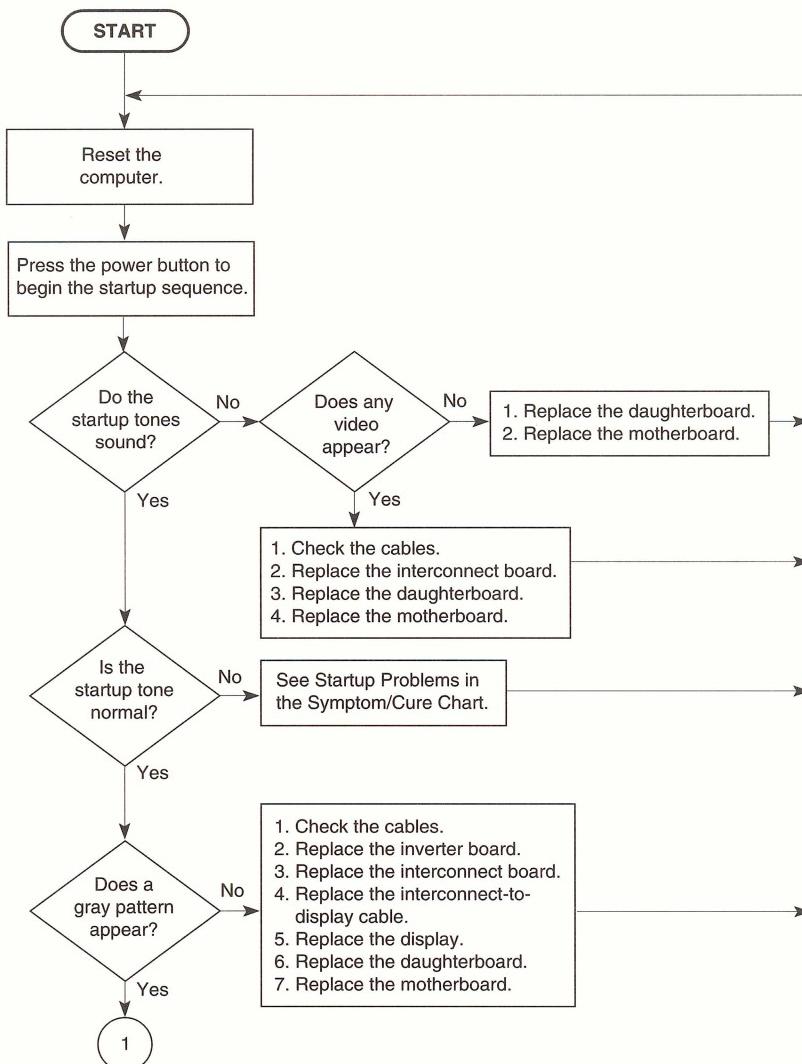
Hard Drive	
Cable, HDA-to-Logic Board.....	922-0779
HDA Bracket.....	922-0770
HDA, 160 MB, 2.5" SCSI.....	661-0778
HDA, 240 MB, 2.5" SCSI.....	661-0895
HDA, 320 MB, 2.5" SCSI.....	661-0896
Interconnect Board/Cables	
Cable, Interconnect-to-Display (PB 520)	922-1115
Cable, Interconnect-to-Display (PB 520c)	922-1114
Cable, Interconnect-to-Display (PB 540).....	922-1113
Kit, Cables, Interconnect-to-Display (Pkg. of 3) (PB 540c)	076-0467
Cable, Interconnect-to-Inverter.....	922-0776
Cable, Interconnect-to-Logic Board.....	922-0778
Interconnect Board	922-0775
Keyboard	
Keyboard, US	661-0037
Keyboard, British.....	B661-0037
Keyboard, French.....	F661-0037
Keyboard, French Canadian.....	C661-0037
Keyboard, German	D661-0037
Keyboard, Italian	T661-0037
Keyboard, Japanese.....	J661-0037
Keyboard, Spanish.....	E661-0037
Keyboard, Swedish.....	S661-0037
Motherboard/Daughterboard	
Daughterboard, 25 MHz, 4 MB, Rev. A.....	661-0059
Daughterboard, 33 MHz, 4 MB, Rev. A.....	661-0057
Fuse (Pkg. of 20).....	922-1116
Motherboard with Fuse, Rev. A.....	661-0054
Shield, Daughterboard, EMI (Pkg. of 2)	922-0773
Trackpad Assembly	
Trackpad	661-0038
Trackpad Actuator (Pkg. of 10)	922-0785
Trackpad Cable Assembly	922-0769
Miscellaneous	
Cable, AC Power.....	922-0054
Screw Kit	076-0469

Specifications – PowerBook 520, 520c, 540, 540c

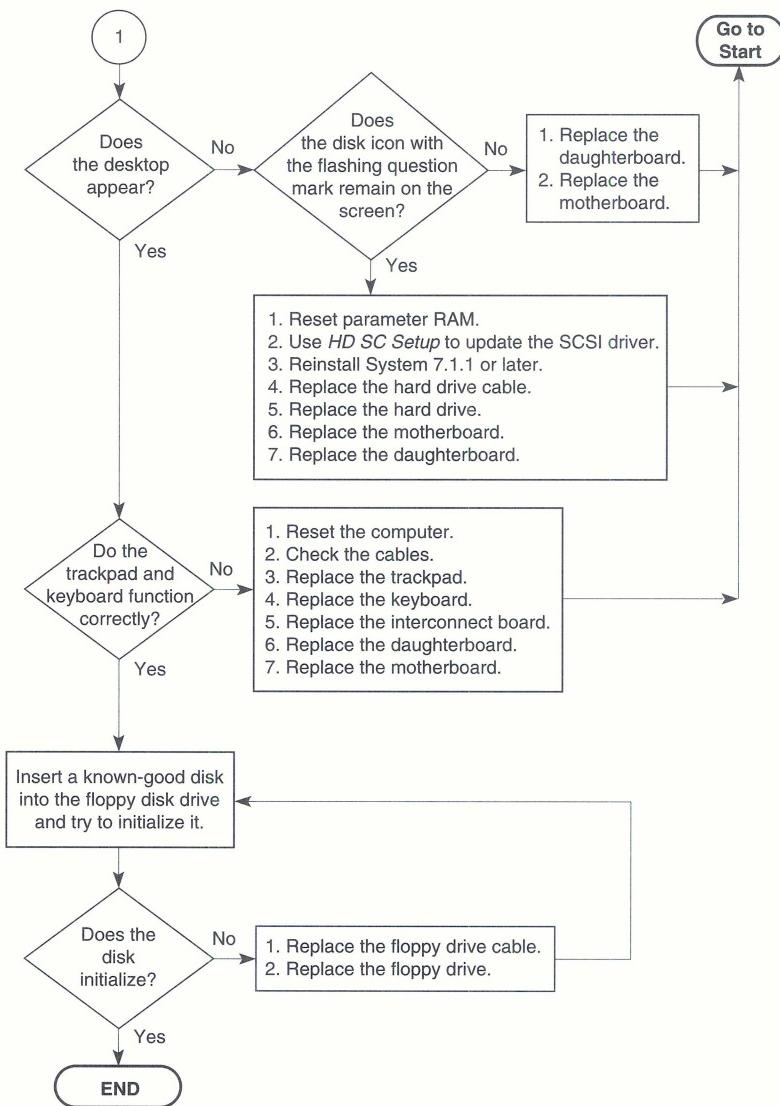
Configuration	PowerBook 520: 68LC040 at 50/25 MHz, 4 MB RAM, FSTN grayscale display, 160 MB hard drive, 1.4 MB floppy drive, NiMH battery, AC adapter, built-in stereo speakers and microphone, built-in AppleTalk and high-speed Ethernet PowerBook 520c: 68LC040 at 50/25 MHz, 4 MB RAM, dual-scan color display, 160 MB hard drive, 1.4 MB floppy drive, NiMH battery, AC adapter, built-in stereo speakers and microphone, built-in AppleTalk and high-speed Ethernet PowerBook 540: 68LC040 at 66/33 MHz, 4 MB RAM, active-matrix grayscale display, 240 MB hard drive, 1.4 MB floppy drive, two NiMH batteries, AC adapter, built-in stereo speakers and microphone, built-in AppleTalk and high-speed Ethernet PowerBook 540c: 68LC040 at 66/33 MHz, 4 MB RAM, active-matrix color display, 320 MB hard drive, 1.4 MB floppy drive, two NiMH batteries, AC adapter, built-in stereo speakers and microphone, built-in AppleTalk and high-speed Ethernet Options: Internal modem, country modem adapter, RAM expansion card, PCMCIA expansion module, NiMH battery, battery bay cover, HDI-30 SCSI system cable, HDI-30 SCSI disk adapter
Processor	Motorola 68LC040 microprocessor; 50/25 MHz (520/520c), 66/33 MHz (540/540c) Addressing: 32-bit internal registers, address bus and data bus
Memory	RAM: 4 MB expandable to 36 MB (using third-party SIMMs) ROM: 2 MB PRAM: 256 bytes of parameter memory VRAM: 512K of static video display memory Clock/Calendar: Custom chip with long-life lithium battery
Disk Storage	Floppy Drive: Internal, 15 mm high, 1.4 MB Apple SuperDrive Hard Drive: 2.5 in. (many capacities)
I/O Interfaces	Ethernet: High-speed Ethernet port; Apple AUI connector SCSI: HDI-30 SCSI port with 1.5 MB/sec. transfer rate; supports up to six external SCSI devices; connection to another computer requires HDI-30 SCSI system cable ADB: ADB port; 200 mA max. current draw for all ADB devices Serial: RS-422 serial port; mini DIN-8 connector Sound: Stereo sound-in port; stereo sound-out headphones jack; standard 3.5 mm stereo miniplugs Video: Micro DV-14 video-out port; 8-bit, 256 color video output; supports most Macintosh monitors, VGA monitors, and SVGA monitors Power Adapter: Power adapter port Modem: Slot for optional modem Security: Slot for third-party security equipment PDS: 90-pin processor-direct slot for PDS devices or optional PCMCIA expansion module (allowing use of two type II or one type III PCMCIA-type card)

I/O Devices	Keyboard: Built-in standard Apple keyboard with 12 function keys; 76 keys domestic; 77 keys ISO; two-level tilt adjustment Trackpad: Solid-state trackpad Microphone: Electret, omnidirectional; output voltage of 4 mV, peak-to-peak
Sound and Video	PowerBook 520 Display: 9.5 in. (24 cm) diagonal screen; backlit, FSTN grayscale display (16 levels); 640 x 480 pixels PowerBook 520c Display: 9.5 in. (24 cm) diagonal screen; backlit, dual-scan color display (256 levels); 640 x 480 pixels PowerBook 540 Display: 9.5 in. (24 cm) diagonal screen; backlit, active-matrix grayscale display (16 levels); 640 x 480 pixels PowerBook 540c Display: 9.5 in. (24 cm) diagonal screen; backlit, active-matrix color display; 640 x 400 pixels at thousands of colors; 640 x 480 pixels at 256 colors Sound: 16-bit sound capable of driving headphones or other stereo equipment through the sound jack; built-in stereo speakers
Electrical	Main Battery: NiMH; provides 2-4 hours of usage before recharging Backup Battery: Rechargeable lithium Power Adapter: 100-240 VAC line voltage; 40 W
Physical	Height: 2.25 in. Width: 11.5 in. Depth: 9.65 in. Weight (with battery): 6.4 lb. (520/520c) 7.3 lb. (540/540c)
Other	Internal Modem: Sends and receives data at 19.2 bps; sends and receives faxes at 14.4 bps SCSI Adapter: Enables connection between PowerBook computer and desktop Macintosh (PowerBook appears as a hard drive on the desktop)

Troubleshooting Flowchart – PowerBook 520, 520c, 540, 540c



Flowchart 1 Startup Problems



Flowchart 2 Startup Problems

Symptom/Cure – PowerBook 520, 520c, 540, 540c

Startup Problems Solutions

RAM failure occurs (eight-tone error chord sequence sounds after startup chord)

1. Startup from Disk Tools disk.
2. Reseat RAM expansion card and check connection.
3. Replace RAM expansion card.
4. Replace daughterboard.
5. Replace motherboard.

Hardware failure occurs (four-tone error chord sequence sounds after startup chord)

1. Startup from Disk Tools disk.
2. Disconnect hard drive cable and restart computer. If startup sequence is normal, reconnect cable and retest.
3. Replace hard drive.
4. Disconnect floppy drive cable and restart computer. If startup sequence is normal, reconnect cable and retest.
5. Replace floppy drive.
6. Replace motherboard.

Power Problems Solutions

Screen is blank; computer doesn't respond

1. Reset Power Manager.
2. Restart computer.
3. Connect power adapter and restart computer in 3-4 minutes.
4. Try known-good, charged main battery.
5. Check all interconnect board, daughterboard, and motherboard connections.
6. Replace keyboard.
7. Replace interconnect board.
8. Replace daughterboard.
9. Replace motherboard.

After you remove main battery, some control panel settings are different

1. Check cables.
2. Replace backup battery.
3. Replace interconnect board.
4. Replace daughterboard.
5. Replace motherboard.

Power adapter is plugged in, but Control Strip does not indicate adapter is connected

1. Check power adapter connection.
2. Try known-good, charged main battery.
3. Try known-good power adapter.
4. Replace motherboard.

Video Problems	Solutions
Low-power warning appears	<ol style="list-style-type: none"> 1. Reset Power Manager. 2. Recharge battery or attach power adapter. 3. Verify that peripherals are low-power. 4. Reduce use of floppy or hard drive, modem, sound, backlight, or other power consuming devices, or connect power adapter. 5. Try known-good, charged main battery. 6. Try known-good power adapter. 7. Replace motherboard.
Computer runs when plugged into wall outlet but not on battery power; battery voltage is within tolerance.	<ol style="list-style-type: none"> 1. Reset Power Manager. 2. Replace motherboard. 3. Return computer to Apple.
Pixel never comes on or is always on	<ol style="list-style-type: none"> 1. If more than five pixels do not come on or are always on, replace display.
Row or partial row of pixels never comes on or is always on	<ol style="list-style-type: none"> 1. Check display cables. 2. Replace interconnect-to-display cables. 3. Replace display. 4. Replace interconnect board. 5. Replace the daughterboard.
Display is very light or totally white	<ol style="list-style-type: none"> 1. Adjust screen contrast and brightness settings. 2. Check cable, inverter board, interconnect board, daughterboard, and motherboard connections. 3. Replace inverter board. 4. Replace interconnect board. 5. Replace interconnect-to-display cable. 6. Replace display. 7. Replace daughterboard. 8. Replace motherboard.
Screen brightness is not uniform	<ol style="list-style-type: none"> 1. This effect is normal for the PowerBook 520/520c screen. Diminish the effect by adjusting contrast and brightness. 2. PowerBook 540/540c - replace display.
Screen stopped working or dimmed but is fine now	<ol style="list-style-type: none"> 1. If temperature is under 5° C or over 40° C, this reaction is normal for PowerBook 520/520c screens.

Backlight doesn't operate	<ol style="list-style-type: none">1. Verify that brightness cable connection is secure.2. Check cable, inverter board, interconnect board, daughterboard, and motherboard connections.3. Verify that cables are not pinched or severed.4. Replace inverter board.5. Replace interconnect-to-inverter cable.6. Replace interconnect board.7. Replace interconnect-to-display cable.8. Replace display.9. Replace daughterboard.10. Replace motherboard.
Screen goes blank	<ol style="list-style-type: none">1. Press any key to wake computer from system sleep.2. Check interconnect-to-display cable connection.3. Reseat daughterboard.4. Replace daughterboard.5. Replace inverter, display cable, display.
No display, but computer appears to operate correctly	<ol style="list-style-type: none">1. Adjust screen contrast and brightness settings.2. Verify cable, inverter board, interconnect board, daughterboard, and motherboard connections.3. Connect power adapter.4. Replace inverter board.5. Replace interconnect board.6. Replace interconnect-to-display cable.7. Replace display.8. Replace daughterboard.9. Replace motherboard.

Floppy Drive Problems

Solutions

Audio and video are present, but internal floppy drive does not operate	<ol style="list-style-type: none">1. Restart with extensions off.2. Try known-good floppy disk.3. Check floppy drive cable connection.4. Replace floppy drive cable.5. Replace floppy drive.6. Replace daughterboard.7. Replace motherboard.
Disk initialization fails	<ol style="list-style-type: none">1. Restart with extensions off.2. Try known-good floppy disk.3. Check floppy drive cable connection.4. Replace floppy drive cable.5. Replace floppy drive.

-
- 
- | | |
|---|--|
| Disk ejects while booting;
display shows Mac icon
with blinking "X" | <ol style="list-style-type: none">1. Try known-good system disk. (Must be System 7.1.1 or later.)2. Verify that trackpad button is working.3. Check floppy drive cable connection.4. Replace floppy drive cable.5. Replace floppy drive.6. Replace motherboard. |
| Disk does not eject | <ol style="list-style-type: none">1. Shut down system and hold trackpad button down while you switch system on.2. Insert opened paper clip into hole below drive.3. Check floppy drive cable connection.4. Reinstall floppy drive brackets.5. Replace floppy drive cable.6. Replace floppy drive.7. Replace daughterboard.8. Replace motherboard. |
| Read/write/copy error | <ol style="list-style-type: none">1. Try known-good floppy disk.2. Check floppy drive cable.3. Replace floppy drive cable.4. Replace floppy drive.5. Replace motherboard. |

Hard Drive Problems	Solutions
Internal hard drive does not operate	<ol style="list-style-type: none">1. Disconnect external SCSI devices.2. Check internal hard drive data cable connection.3. Startup from Disk Tools disk. Use HD SC Setup to determine whether computer recognizes drive. If it does, try to reinitialize drive. (This will not work with third-party drives.)4. Replace hard drive data cable.5. Replace hard drive.6. Replace motherboard.

Peripheral Problems	Solutions
After you connect external SCSI device, computer does not boot	<ol style="list-style-type: none">1. Switch on external SCSI device before starting computer.2. Check cable connections.3. Verify that chain is terminated correctly.4. Verify that SCSI select switch setting on external device is unique.5. Verify operation of internal hard drive.6. Try known-good external SCSI device.7. Startup from Disk Tools disk and scan SCSI bus for drives.8. Replace motherboard.
Cursor does not move when you use trackpad	<ol style="list-style-type: none">1. Reset computer. Hold down Control and Command keys and then switch power on.2. Check trackpad connections.3. Check interconnect board, daughterboard, and motherboard connections.4. Connect low-power mouse and try to move cursor. If cursor moves, try using trackpad and keyboard. If trackpad does not move cursor, replace trackpad. If keyboard does not move cursor, replace keyboard.5. Replace interconnect board.6. Replace daughterboard.7. Replace motherboard.
Cursor doesn't move when you use mouse	<ol style="list-style-type: none">1. Check mouse connection to ADB port.2. Reset computer. Hold down Control and Command keys and then switch power on.3. Clean mouse ball and inside of mouse.4. Replace mouse.5. Replace motherboard.
Cursor intermittently does not move or moves erratically	<ol style="list-style-type: none">1. Make sure one fingertip only is touching the trackpad.2. Reset computer. Hold down Control and Command keys and then switch power on.3. Check trackpad connections.4. Replace trackpad.5. Replace keyboard.6. Replace interconnect board.7. Replace motherboard.

-
- | | |
|--|--|
| Device connected to external modem port doesn't work | <ol style="list-style-type: none">1. Verify that External Modem is selected in CDEV.2. Verify that System is 7.1.1 or later.3. Check cables.4. Test device with known-good computer.5. Replace daughterboard.6. Replace motherboard. |
| I/O devices are unrecognized or garbage is transmitted or received | <ol style="list-style-type: none">1. Verify that System is 7.1.1 or later.2. Check cables.3. Verify that SCSI device is correctly terminated.4. Verify that SCSI select switch setting on external device is unique.5. Test device with known-good computer.6. Replace daughterboard.7. Replace motherboard. |

Internal Fax/Data Modem Problems

Solutions

- | | |
|---|---|
| Internal modem options don't appear in CDEV when modem is installed | <ol style="list-style-type: none">1. Make sure System is 7.1.1 or later.2. Reseat modem card.3. Replace modem card.4. Replace motherboard. |
| Modem doesn't respond properly to AT command set instructions | <ol style="list-style-type: none">1. Make sure CDEV is set correctly for modem.2. Verify that baud rate and data format settings of communications application are compatible with internal modem and remote modem.3. Check phone cord connection and operation.4. Make sure System is 7.1.1 or later.5. Reseat modem card.6. Replace modem card. |
| Strange mix of characters appears on screen | <ol style="list-style-type: none">1. Verify that baud rate and data format settings of communication application are compatible with internal modem and remote modem.2. Check phone cord connection and operation.3. Verify that System is 7.1.1 or later.4. Reseat modem card.5. Replace modem card.6. Replace daughterboard.7. Replace motherboard. |
| Modem interferes with system sound | <ol style="list-style-type: none">1. Reseat modem card.2. Replace modem card.3. Replace interconnect card.4. Replace motherboard. |

- | | |
|--|---|
| Cursor moves, but clicking trackpad button has no effect | <ol style="list-style-type: none">1. Reset computer. Hold down Control and Command keys and then switch power on.2. Check trackpad connections.3. Check interconnect board, daughterboard, and motherboard connections.4. Replace trackpad.5. Replace keyboard.6. Replace interconnect board.7. Replace daughterboard.8. Replace motherboard. |
| No response to any key on keyboard | <ol style="list-style-type: none">1. Verify that computer is on.2. Reset computer. Hold down Control and Command keys and then switch power on.3. Check keyboard and interconnect board connections.4. Replace keyboard.5. Replace interconnect board.6. Replace motherboard. |
| Known-good direct-connect printer doesn't print | <ol style="list-style-type: none">1. Make sure that System is 7.1.1 or later.2. Make sure that Chooser is set correctly.3. Make sure port is not used by modem software. Check CDEV.4. Check cables.5. Verify printer cable is securely attached.6. Replace printer cable.7. Try known-good printer.8. Replace daughterboard.9. Replace motherboard. |
| Known-good network printer doesn't print | <ol style="list-style-type: none">1. Make sure that System software is 7.1.1 or later.2. Make sure that Chooser is set correctly.3. Make sure Network control panel is set for built-in.4. Check cables.5. Verify printer cabling is securely attached.6. Replace printer cable.7. Try another printer. If printer works, computer is OK. Refer to network information on <i>Service Source</i> for further assistance.8. Replace daughterboard.9. Replace motherboard. |

Miscellaneous Problems	Solutions
Modem does not respond to incoming call	<ol style="list-style-type: none"> 1. If computer is in sleep mode, verify that Wake On Ring option in CDEV is selected. 2. Check phone cord connection and operation. 3. Replace modem card. 4. Replace motherboard.
Modem has no sound output	<ol style="list-style-type: none"> 1. Verify that Volume control panel setting is above 0. 2. Type ATM1 to turn speaker on. 3. Type ATM0 to turn speaker off. 4. Type AT&F to restore all factory presets. 5. Replace modem card. 6. Replace interconnect card. 7. Replace motherboard.
Modem connects but does not communicate with remote modem	<ol style="list-style-type: none"> 1. Verify that remote modem needs error correction (error correction is internal modem default). 2. Type AT&QO to disable error correction.
<hr/>	
No sound from speaker	<ol style="list-style-type: none"> 1. Verify that Volume control panel setting is above 0. 2. Verify that no external speaker is plugged in. 3. Check connections of speaker to interconnect board and interconnect board to motherboard. 4. Replace interconnect board. 5. Replace motherboard.
Unit boots with normal chime, but no image on display	<ol style="list-style-type: none"> 1. Reset Power Manager. 2. Reseat Interconnect cable. 3. Reseat display cable. 4. Replace display cable. 5. Replace display.

Additional Procedures

Modem and DAA Card Installation

▲ Caution The PowerBook 520/540 series contains CMOS devices that are very susceptible to ESD damage. To prevent ESD damage, wear a grounding wriststrap. Review the ESD precautions in Chapter 1, CRT and ESD Safety.

1. Remove the main battery, clutch covers, display access cover, display assembly, keyboard, hard drive, center base cover, floppy drive, daughterboard EMI shield, top case, interconnect-to-logic board cable, CPU stiffener, and RAM card (if installed).
2. Slide the modem card under the RAM card guides and connect the modem card to the motherboard.
3. Pull up and remove the modem cap.
4. Install the modem port frame on the DAA card.
5. Connect the DAA card to the motherboard.
6. Install the DAA mounting screw.

Modem Country Adapter

The modem country adapter connects the modem in a PowerBook 520/540 series computer to the public switched telephone network (PSTN) of a given country. No adapter is necessary in the country for which the computer is localized. However, a country-specific adapter (see list below) must be purchased for each new country in which the PowerBook will be used.

Country	Adapter	Country	Adapter
United States	922-0897	Japan	J922-0897
Canada	C922-0897	Denmark	D922-0897
France	F922-0897	Finland	K922-0897
Germany	D922-0897	Norway	H922-0897
Italy	T922-0897	Spain	E922-0897
Sweden	S922-0897	Australia	X922-0897
Holland	N922-0897	Switzerland	SF922-0897
Great Britain	B922-0897	New Zealand	NZ922-0897

To Use The Adapter

1. Insert the adapter's male plug into the internal modem port on the back panel of the computer.
2. Plug the country-specific cable (available locally) into the female receptacle on the adapter.
3. Plug the other end of the cable into the FSTN receptacle.
4. Switch on the computer.

RAM Expansion Card

▲ Caution Handle the RAM expansion card by the edges only. Do not touch any components on the card. When installing the RAM expansion card, press down on the edge of the card directly above the connector. Be careful not to apply pressure to any components or you may permanently damage the card.

1. Remove the main battery.
2. Remove the keyboard.
3. Remove the center base cover.
4. Remove the daughterboard EMI shield.
5. Remove the plastic retainer bar.
6. Position the edge of the RAM card in the two guides and connect the card to the daughterboard.

PowerBook 540c Upgrade

A PowerBook 540c upgrade kit upgrades the display of a PowerBook 520, PowerBook 520c, or PowerBook 540 to a PowerBook 540c display. The upgrade kit consists of a PowerBook 540c display assembly.

1. Remove the main battery.
2. Remove the clutch covers.
3. Remove the display access cover.
4. Remove the display assembly.
5. Install the PowerBook 540c display assembly.

Logic Board Diagrams

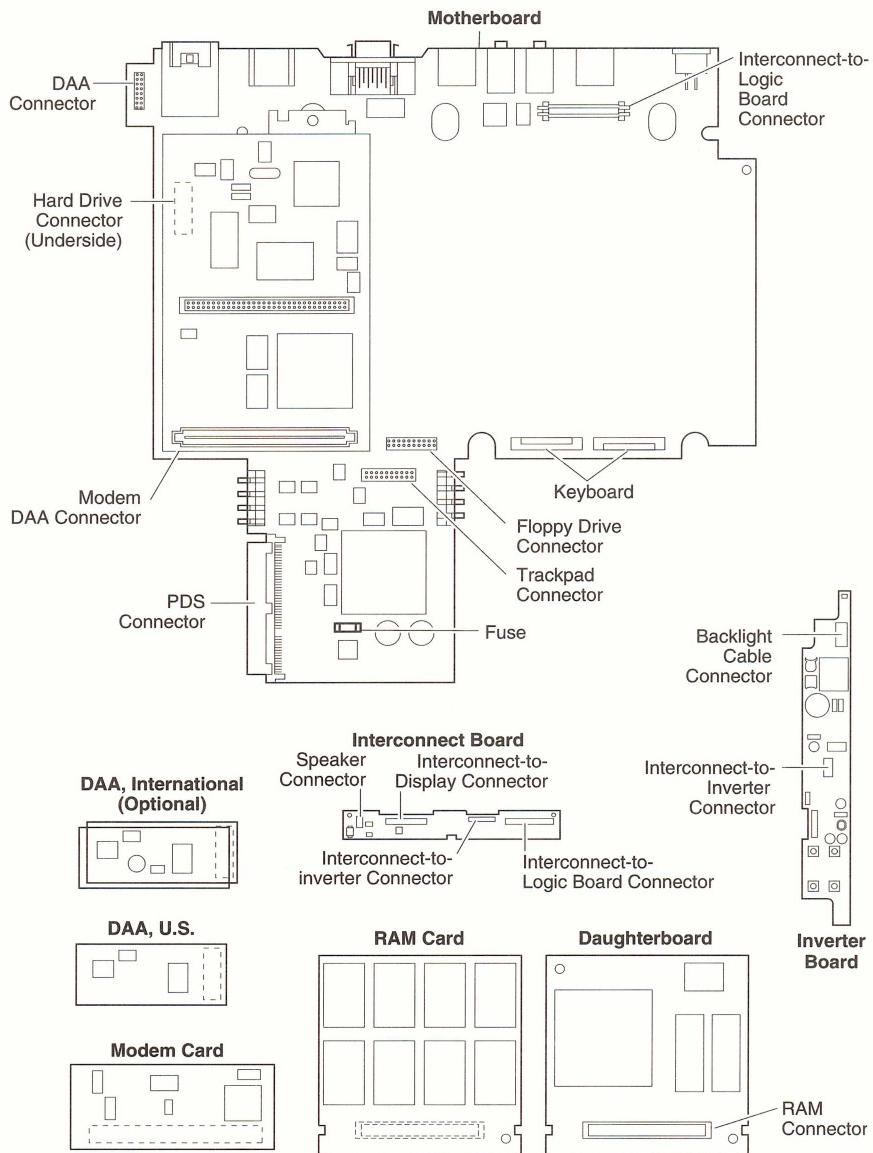
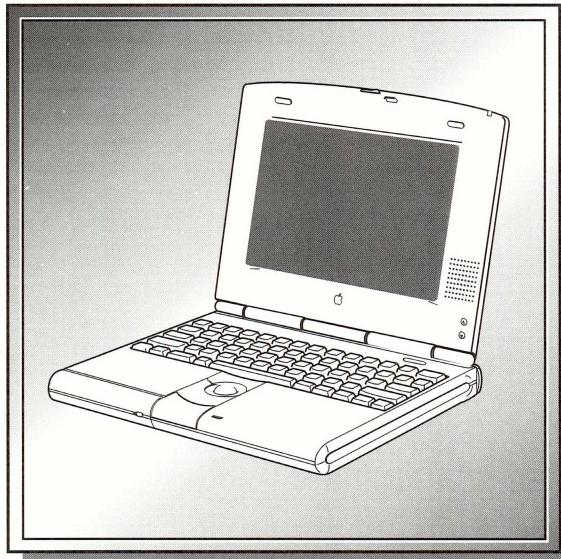


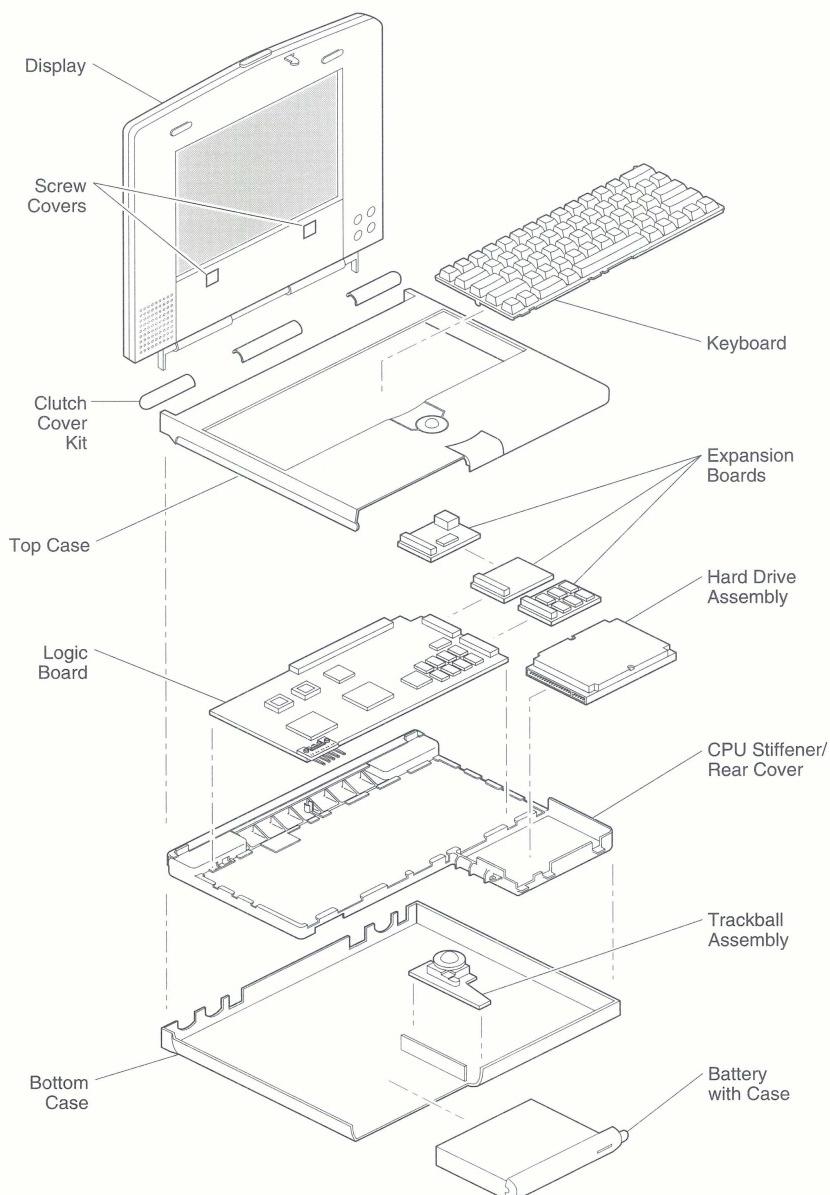
Figure 2 Logic Board

PowerBook Duo 250, 270c, 280, 280c



Illustrated Parts List	298
Specifications	302
Symptom/Cure Chart	304
Additional Procedures	314
PowerBook Duo Upgrades	321
Logic Board Diagrams	322

Illustrated Parts List – PowerBook Duo 250, 270c, 280, 280c



This is a generic representation of a product family. Configurations may vary.

Figure 1 Exploded View

Battery/Power Adapter	
Battery Case, Type 1/2, Duo .....	.922-0086
Battery Connector Bracket .....	.815-1268
Battery w/Door, Type 1, Duo .....	.661-1656
Battery w/Door, Type 2, Duo .....	.661-1735
Battery w/Door, Type 3, Duo .....	.661-0053
Battery Door, Type 1, Duo.....	.616-0004
Battery Door, Type 2/3, Duo.....	.922-0435
Duo Battery Contact Alignment Tool.....	.077-0085
External Battery Charger, Type 1, Duo .....	.922-0081
External Battery Charger, Type 1/2/3, Duo .....	.922-0576
Power Adapter, 25 W .....	.922-0082
Power Adapter, 36 W .....	.922-0791
Clutch Assembly	
Clutch Cover Kit, PowerBook Duo .....	.076-0063
Clutch Retainer Clip (2) .....	.922-0090
Screw Kit, PowerBook Duo .....	.076-0072
CPU Stiffener/Rear Cover	
Actuator, Display Assembly.....	.922-0093
CPU Stiffener, (Duo 250/270c/280/280c).....	.076-0339
CPU Stiffener, (Duo 250/270c).....	.922-0433
Display Switch Assembly .....	.922-0092
Flip Foot, Left .....	.922-0087
Flip Foot, Right.....	.922-0088
Flip Foot Cap Kit.....	.076-0073
I/O Door with Link.....	.076-0074
Modem Cap .....	.922-0080
Rear Cover .....	.600-0136
Screw Kit .....	.076-0072
Display Assembly	
Brightness Actuator Assembly, (Duo 270c), Int'l.....	.922-0578
Cover, Display Screw (100 pack) .....	.922-2029
Display, Active-Matrix, (Duo 270c), Int'l .....	.661-1734
Display, Active-Matrix, (Duo 280), Int'l .....	.661-0052
Display Cable, (Duo 270c), Int'l.....	.922-0577
Display Cable, (Duo 280c), Int'l.....	.922-0796
Display Housing Kit, (Duo 270c), Int'l.....	.076-0100
Inverter, (Duo 270c), Int'l.....	.922-0431
Kit, Clutches, (Duo 270c), Int'l.....	.076-0128
Latch Mechanism, (Display Duo 250), Int'l.....	.076-0080
Latch Mechanism, (Display Duo 270c), Int'l.....	.076-0087
Shield, Display EMI, (Duo 270c), Int'l.....	.922-0579
Speaker Assembly, (Duo 270c), Int'l.....	.922-0432

Drive Assemblies	
Bracket, HDA, 2.5" (Bag of 2).....	922-0705
Bracket, Hard Drive (replaced by 922-0705).....	805-0225
Cable, Flex, 19 mm-high Floppy Drive	821-0655
Cable, HDA, 80/120 MB.....	922-0398
Cable, HDI-20, Drive to CPU.....	590-0719
Door, HDI-20 External Floppy Drive.....	603-5010
Door Retainer Pins, HDI-20 External Floppy Drive	603-5011
Floppy Adapter, PowerBook Duo	661-1663
Floppy Drive, 1.4 MB, 19mm-high.....	661-1651
HDA, 80 MB, 2.5" SCSI	661-0796
HDA, 120 MB, 2.5" SCSI.....	661-0772
HDA, 160 MB, 2.5" SCSI.....	661-0060
HDA, 320 MB, 2.5" SCSI.....	661-0896
HDA, 240 MB, 2.5" SCSI.....	661-0014
Screw Kit, PowerBook Duo	076-0072
Expansion Boards	
DRAM Expansion Card, 4 MB.....	661-1659
DRAM Expansion Card, 8 MB.....	661-1658
Modem, Express, 14.4 Baud, Domestic, Duo	661-1665
Modem, Express, 14.4 Baud, Duo	661-1662
On/Off PCB	922-0096
Keyboard	
Keyboard, Domestic	661-1652
Keyboard, Domestic, Rev. D	661-1608
Keyboard, British.....	B661-1652
Keyboard, French.....	F661-1652
Keyboard, French Canadian.....	C661-1652
Keyboard, German	D661-1652
Keyboard, Italian	T661-1652
Keyboard, Japanese.....	J661-1652
Keyboard, Spanish.....	E661-1652
Keyboard, Swedish	S661-1652
Keyboard, Granite	AU661-1652
Logic Board	
Logic Board, 33 MHz (Duo 250).....	661-1672
Logic Board (Duo 270c)	661-1717
Logic Board (Duo 280/280c)	661-0051
Microphone Assembly	922-0083
Screw Kit	076-0072
Top/Bottom Case	
Backup Battery w/cable.....	630-6546
Case Bottom w/labels, PB Duo	076-0419

Case Top (Duo 250/270c).....	620-0045
Case Top (Duo 280).....	922-0792
Case Top (Duo 280c).....	922-0793
Rubber Bumper (2).....	922-0089
Trackball Assembly	
Ball, Trackball.....	922-0084
Retainer, Trackball	922-0085
Trackball Assembly	661-1654
Miscellaneous	
Gasket, Modem/Switch, Bag of 100.....	922-2034
Label, Blank for Serial Number (10 pack)	922-0411
Label, Product ID, External 1.4 MB Floppy (Pkg. of 10).....	922-1106
Plug Wall Mount, AC Adapter (Pkg. of 5).....	922-0544
Power Cord, AC	922-0054
Screw Kit	076-0072
Service Packaging, HDA, 2.5 Drives.....	602-0307

Specifications – PowerBook Duo 250, 270c, 280, 280c

Processor	PowerBook Duo (250, 270c): Motorola 68030 microprocessor; 33 MHz PowerBook Duo (280, 280c): Motorola 68LC040 microprocessor; 66/33 MHz Coprocessor: Motorola 68882 floating-point microprocessor (270c only) Addressing: 32-bit internal registers, address, data bus supports 4 GB of address with justified 8-bit, 16-bit, and 32-bit transactions
Memory	DRAM (250, 270c): 4 MB, expandable to 24 MB; (270c is expandable to 32 MB); requires 70 ns or faster DRAM chips DRAM (280, 280c): 4 MB, expandable to 40 MB; requires 70 ns or faster DRAM chips ROM: 1 MB PRAM: 256 bytes of parameter memory Clock/Calendar: CMOS custom chip with long-life lithium battery
Disk Storage	Floppy Drive: External 1.4 MB floppy drive (same drive is used with PowerBook 100); requires Duo Floppy Adapter or Duo MiniDock Hard Drive (250, 270c): 2.5-in., 17 mm high (various) Hard Drive (280, 280c): 2.5-in. (International only) Internal 200, 240, or 320 MB hard drive
I/O Interfaces	Docking Connector: 152-pin processor-direct slot (PDS) connector for attaching expansion devices; 32-bit expansion bus Modem: Optional internal modem/telephone jack; RJ-11 domestic; mini DIN-8 international Serial: RS-422 serial port; mini DIN-8 connector
I/O Devices	Keyboard: Built-in standard Apple keyboard Microphone: Built-in electret omnidirectional microphone Trackball: 19 mm diameter, dual button; Apple Desktop Bus (ADB) interface
Sound and Video	Sound: Custom digital Apple Sound Chip (ASC); monophonic sound in and sound out Video Display (250/270c/280): 9-in. (229 mm) diagonal screen; Flat-panel, color, active-matrix 640 x 400 pixels Video Display (280c): 8.4-in. diagonal screen; flat-panel, color, active-matrix 640 x 480 pixels
Electrical	Main Battery (250/270c): NiMH (nickel-metal-hydride), 1.5 Ah Main Battery (280c): NiMH 1.6 Ah; output: 24 VDC, 1.5 A, 36 W PRAM Battery: 3 V lithium backup battery, 30 mA Power Adapter: Input: 85-270 VAC line voltage, 47-63 Hz; Output: 24 VDC, 1.04 A, 25 W

Physical	Height: 10.9 in. Width: 8.5 in. Depth: 1.4 in. (250, 280) 1.5 in. (270c, 280c) Weight: 4.2 lb. (250, 280) 4.8 lb. (270c, 280c)
Other	Express Modem: Internal 14,400-baud modem with fax send/receive capability at 9600 baud; 300-14,000 bps data transmission rates; 2400/4800/7200/9600 bps transmission rates; full duplex operation; asynchronous or framed modes Error correction: V.42 compliance (MNP2-4) Data compression: V.42bis (4 to 1 compression) and MNP-5 (2 to 1 compression); requires 300K of system RAM; built-in support for internal modem when in docking systems SCSI Disk Adapter: Enables connection between PowerBook Duo computer and desktop Macintosh (Duo system appears as a hard drive on the desktop); requires Macintosh Duo MiniDock

Symptom/Cure Chart – PowerBook 250, 270c, 280, 280c

Startup Problems	Solutions
RAM failure occurs (eight-tone error chord sequence sounds after startup chord)	<ol style="list-style-type: none">1. Boot from Disk Tools, if no failure, check system software.2. Check RAM expansion card connection.3. Replace RAM expansion card.4. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Hardware failure occurs (four-tone error chord sequence sounds after startup chord)	<ol style="list-style-type: none">1. Boot from Disk Tools, if no failure, check system software.2. Disconnect hard drive data cable and reboot system. If startup sequence is normal, reseat cable and retest.3. Replace hard drive.4. If the system is connected to an external floppy drive, disconnect drive and reboot system. If startup sequence is normal, reseat cable and retest.5. Replace floppy drive.6. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Power Problems	Solutions
Screen is blank; computer does not respond	<ol style="list-style-type: none">1. Reset Power Manager (See “Additional Procedures.”)2. Simultaneously press the Command, Control, and Power On keys to reset computer.3. Connect power adapter and reboot computer in 3-4 minutes.4. Try known-good, charged main battery.5. Disconnect main battery, backup batteries, and AC adapter. Wait 15 minutes. If computer powers on, install the PowerBook Duo Battery Patch (available on AppleLink).6. Replace keyboard.7. Check CPU stiffener (See “Additional Procedures.”)8. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
After you remove main battery, some control panel settings are different	<ol style="list-style-type: none">1. Replace backup battery.

-
- | | |
|---|---|
| Power adapter is plugged in, but battery DA does not indicate charger is connected | 1. This is normal for fully charged battery.
2. Check power adapter connection.
3. Try known-good, charged main battery.
4. Try known-good power adapter.
5. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |
| Computer intermittently powers off | 1. Properly seat battery.
2. Replace CPU stiffener.
3. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |
| Low-power warning appears | 1. Recharge battery or attach power adapter.
2. Remove external devices.
3. Try known-good, charged main battery.
4. Try known-good power adapter.
5. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |
| Computer runs when plugged into wall outlet but not when using battery power; battery voltage is within tolerance | 1. Disconnect main battery, backup batteries, and AC adapter. Wait 15 minutes. If computer powers on, install the PowerBook Duo Battery Patch (available on AppleLink).
2. Reset Power Manager. (See "Additional Procedures.")
3. Verify the battery voltage.
4. Replace main battery.
5. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |
| System powers off unexpectedly, system errors occur, or system hangs up. Symptoms usually occur in these situations:
Keyboard is used while PowerBook Duo flip feet are down, PowerBook Duo is inserted in Duo Dock, or PowerBook Duo is attached to MiniDock. | 1. Make sure that logic board mounting screw that also serves as battery contact is installed. (Screw should be installed on contact located on right side.)
2. Use the Battery Contact Alignment Tool. (See "Additional Procedures.") |

Video Problems	Solutions
Row or partial row of pixels never comes on or is always on	<p>PowerBook Duo 250:</p> <ol style="list-style-type: none"> 1. Check display cable connection. 2. Replace display. (International only.) 3. Replace logic board. 4. Return computer to Apple.
Thin white line is always on at middle of screen (Duo 250)	<p>PowerBook Duo 270c:</p> <ol style="list-style-type: none"> 1. Check display cable connection. 2. Replace display cable. (International only.) 3. Replace display. (International only.) 4. Replace logic board. 5. Return computer to Apple.
Display is very light or totally white	<p>PowerBook Duo 250:</p> <ol style="list-style-type: none"> 1. Adjust screen contrast. 2. Replace display (International only.) 3. Return computer to Apple.
No display, but computer appears to operate correctly	<p>PowerBook Duo 270c:</p> <ol style="list-style-type: none"> 1. Adjust screen contrast. 2. Check logic board cable connections. 3. Replace inverter board. (International only.) 4. Replace display cable. (International only.) 5. Replace display. (International only.) 6. Replace logic board. 7. Return computer to Apple. <p>PowerBook Duo 250:</p> <ol style="list-style-type: none"> 1. Adjust screen contrast. 2. Check logic board cable connections. 3. Connect power adapter. 4. Disconnect main battery, backup batteries, and AC adapter. Wait 15 minutes. If computer powers on, install the PowerBook Duo Battery Patch (available on AppleLink). 5. Replace display. (International only.) 6. Replace logic board. 7. Return computer to Apple.

-
- | | |
|---|--|
| | PowerBook Duo 270c:
1. Adjust screen contrast.
2. Check logic board cable connections.
3. Connect power adapter.
4. Replace inverter board. (International only.)
5. Replace display cable. (International only.)
6. Replace display. (International only.)
7. Replace logic board.
8. Return computer to Apple. |
| Screen brightness is not uniform (Duo 250/270c) | 1. Replace display (International only.)
2. Return computer to Apple. |
| Backlight does not operate | PowerBook Duo 250:
1. Check display cable connection.
2. Replace display. (International only.)
3. Replace logic board.
4. Return computer to Apple. |
| | PowerBook Duo 270c:
1. Check display cable connection.
2. Replace inverter board. (International only.)
3. Replace display cable. (International only.)
4. Replace display. (International only.)
5. Replace logic board.
6. Return computer to Apple. |
| Screen goes blank | PowerBook Duo 250/270c:
1. Press any key or press Wake Up key to wake computer from system sleep.
2. Check display cable connection. |
| Screen flickers | PowerBook Duo 250:
1. Some flickering is normal for grayscale displays.
2. Set display to 1-bit mode (black and white) in Monitors control panel.
3. Check display cable connection.
4. Replace display. (International only.)
5. Replace logic board.
6. Return computer to Apple. |

External Floppy Drive Problems	Solutions
Audio and video present, but external drive does not operate	<ol style="list-style-type: none"> 1. Check floppy-adapter-to-PowerBook connection. 2. Try known-good floppy disk. 3. Check floppy drive cable connection. 4. Replace floppy adapter. 5. Replace floppy drive cable. 6. Replace floppy drive. 7. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Disk ejects while booting; display shows Mac icon with blinking "X"	<ol style="list-style-type: none"> 1. Try known-good system disk. 2. Verify that trackball or mouse button is not stuck. 3. Check floppy drive cable connection. 4. Replace floppy adapter. 5. Replace floppy drive cable. 6. Replace floppy drive. 7. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Disk does not eject	<ol style="list-style-type: none"> 1. Switch off system and hold mouse or trackball button down while you switch system on. 2. Insert straightened paper clip into hole below to drive opening to eject disk. 3. Check floppy drive cable connection. 4. Replace floppy adapter. 5. Replace floppy drive cable. 6. Replace floppy drive. 7. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Disk initialization fails	<ol style="list-style-type: none"> 1. Try known-good floppy disk. 2. Check floppy drive cable connection. 3. Replace floppy adapter. 4. Replace floppy drive cable. 5. Replace floppy drive.
Read/write/copy error	<ol style="list-style-type: none"> 1. Try known-good floppy disk. 2. Check floppy drive cable connection. 3. Replace floppy adapter. 4. Replace floppy drive cable. 5. Replace floppy drive. 6. Replace motherboard.

Hard Drive Problems	Solutions
Internal hard drive does not operate	<ol style="list-style-type: none">1. Check internal hard drive cable connection.2. Replace internal hard drive cable.3. Run Macintosh Hard Disk Test.4. Use HD SC Setup to reinitialize drive.5. Replace internal hard drive.6. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Peripheral Problems	Solutions
Cursor intermittently does not move or moves erratically	<ol style="list-style-type: none">1. Clean ball and rollers of trackball.2. Replace trackball.3. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Cursor moves, but clicking trackball button has no effect	<ol style="list-style-type: none">1. Simultaneously press Command, Control, and Power On keys to reset computer.2. Reboot computer with extensions off by holding down Shift key during startup.3. Check logic board cable connections.4. Replace trackball.5. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Cursor does not move when you are using trackball	<ol style="list-style-type: none">1. Simultaneously press Command, Control, and Power On keys to reset computer.2. Reboot computer with extensions off by holding down Shift key during startup.3. Clean ball and rollers of trackball.4. Make sure display switch cable and battery cable are not impeding trackball.5. Check logic board cable connections.6. Replace trackball.7. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)

-
- | | |
|--|---|
| No response to any key on keyboard | <ol style="list-style-type: none">1. Press Power On key or power button.2. Reboot computer with extensions off by holding down Shift key during startup.3. Adjust Battery Conservation setting in PowerBook control panel.4. Check keyboard cable connection.5. If you are using floppy adapter and external keyboard, replace keyboard cable.6. Replace floppy adapter.7. Replace keyboard.8. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |
| Cursor does not move when you are using floppy adapter and mouse | <ol style="list-style-type: none">1. Check floppy adapter and mouse connections.2. Simultaneously press Command, Control, and Power On keys to reset computer.3. Reboot computer with extensions off by holding down Shift key during startup.4. Clean mouse ball and inside of mouse.5. Replace mouse.6. Replace floppy adapter.7. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |
| Known-good serial printer does not print | <ol style="list-style-type: none">1. Verify that system is 7.1 or later.2. Verify that Chooser and control panel settings are correct.3. Verify that Normal is selected in PowerBook Setup control panel.4. Check cables.5. Replace printer interface cable.6. Try known-good printer.7. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |
| Known-good networked printer does not print | <ol style="list-style-type: none">1. Verify that system is 7.1 or later.2. Verify that Chooser and control panels settings are correct.3. Check cables.4. Test device with known-good computer.5. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |

-
- | | |
|--|---|
| Device connected to mini DIN-8 port does not work | <ol style="list-style-type: none">1. Verify that Normal is selected in PowerBook Setup control panel.2. Verify that system is 7.1 or later.3. Check cables.4. Test device with known-good computer.5. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |
| I/O devices are unrecognized or garbage is transmitted or received | <ol style="list-style-type: none">1. Verify that system is 7.1 or later.2. Check floppy adapter and cable connections.3. Test device with known-good computer.4. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |
| Space bar is hard to press and/or does not work | <ol style="list-style-type: none">1. Loosen keyboard screws. Overtightening can warp keyboard and restrict movement of Space bar. |

Internal Modem Problems

Solutions

- | | |
|--|--|
| Internal modem options do not appear in CDEV | <ol style="list-style-type: none">1. Verify that system is 7.1 or later.2. Verify that current Express Modem software is in use.3. Remove and reseat modem card.4. Replace modem card.5. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |
| Modem does not respond properly to AT command set instructions | <ol style="list-style-type: none">1. Verify that baud rate and data format settings of communications application are compatible with internal modem and remote modem.2. Check phone cord connection and operation.3. Verify that system is 7.1 or later.4. Remove and reseat modem card.5. Replace modem card. |
| Strange mix of characters appears on screen | <ol style="list-style-type: none">1. Verify that baud rate and data format settings of communications application are compatible with internal modem and remote modem.2. Check phone cord connection and operation.3. Verify that system is 7.1 or later.4. Remove and reseat modem card.5. Replace modem card.6. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.) |

Modem interferes with system sound	<ol style="list-style-type: none"> 1. Clear parameter RAM. 2. Remove and reseat modem card. 3. Replace modem card. 4. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Modem does not respond to incoming call	<ol style="list-style-type: none"> 1. Set specific time to "wake up" in the PowerBook control panel. 2. Verify that fax terminal programs set to answer calls. 3. Check phone cord connection and operation. 4. Replace modem card. 5. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Modem has no sound output	<ol style="list-style-type: none"> 1. Verify that Volume control panel setting is 1 or above. 2. Replace modem card. 3. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)
Modem connects but does not communicate with remote modem	<ol style="list-style-type: none"> 1. Verify that remote modem needs error correction (error correction is internal modem default). 2. Add AT&QO to the command line.

Miscellaneous Problems

Solutions

Screen goes blank and computer shuts down every few minutes	<ol style="list-style-type: none"> 1. Adjust Battery Conservation setting in control panel or connect power adapter.
Application seems to run slower after few seconds	<ol style="list-style-type: none"> 1. Adjust Battery Conservation setting in control panel or connect power adapter.
Hard drive is slow to respond, or screen goes blank too often	<ol style="list-style-type: none"> 1. Adjust Battery Conservation setting in control panel or connect power adapter.
No sound from speaker	<p>PowerBook Duo 250:</p> <ol style="list-style-type: none"> 1. Verify that Volume control panel setting is 1 or above. 2. Check display cable connection. 3. Replace display. (International only.) 4. Replace logic board. (When replacing the logic board, check that the EMI clips are securely attached to the CPU stiffener.)

PowerBook Duo 270c:

1. Verify that Volume control panel setting is 1 or above.
2. Check display cable connection.
3. Replace display cable. (International only.)
4. Replace speaker assembly. (International only.)
5. Replace logic board.
6. Return computer to Apple.

Red light on battery
recharger; battery
won't charge

1. Replace Type 1 recharger with Type 2 recharger or replace Type 2 battery with Type 1 battery. Use only Type 1 batteries in a Type 1 battery recharger; Type 2 or Type 3 batteries will not charge in a Type 1 recharger. You can charge Type 1, Type 2, or Type 3 batteries in a Type 2 battery recharger. (See Battery Recharger under "Additional Procedures" for more information.)

Modem

The modem is an option for the PowerBook Duo 250/270c/280/280c.

1. Disconnect the power adapter.
2. Remove the main battery, keyboard, end clutch covers, top case, center clutch cover, hard drive, backup battery, trackball assembly, display assembly, CPU stiffener, and logic board.
3. Remove the modem cap from the rear cover.
4. Disconnect the on/off board. The Apple modem includes the on/off circuitry provided by the on/off board. After installing the modem card, you can discard the on/off board or return it to the customer.
5. Holding the modem card by the edges, connect it to the logic board (Figure 2).

Memory Expansion

1. Disconnect the power adapter.
2. Remove the main battery and keyboard.
3. Holding the DRAM expansion card by the edges, connect the card to the logic board (Figure 2).

To verify that the upgrade is successful, check the Total Memory message (for systems with virtual memory switched off) or the Built-in Memory message (for systems with virtual memory switched on). The memory size should be 4 MB of DRAM plus the amount of DRAM on the expansion card. If the memory size is incorrect, reseat the DRAM card. If the memory size is still incorrect, replace the DRAM expansion card. If the memory size is still incorrect, contact Apple Technical Support.

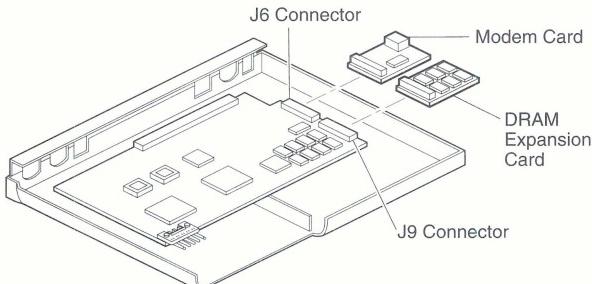


Figure 2 Modem and Memory Cards

Resetting the Power Manager

The Power On button above the keyboard does not reset the Power Manager. To reset the Power Manager chip, press the power switch on the rear of the Duo for 30-45 seconds.

This procedure

- Resets the Power Manager chip
- Fixes some power-related problems
- Removes RAM disks and all their contents

However, this procedure does not reset the Power Manager Code. To reset the Power Manager Code,

1. Remove the power adapter and the main battery.
2. Disconnect the backup battery.
3. Let the PowerBook Duo sit for 10 minutes with all power removed.

Floppy Adapter Installation

The PowerBook Duo Floppy Adapter attaches to the 152-pin docking connector and provides an external floppy drive (HDI-20) port and an ADB port. Replace a defective floppy adapter by whole-unit exchange.

1. To install the floppy adapter, raise the I/O door and push the adapter firmly onto the external 152-pin docking port. Make sure the floppy adapter release button is up.
2. To remove the adapter, depress the release button and pull off the adapter.

Duo Battery Contact Alignment Tool

The battery contact alignment tool aligns the two outer battery contacts (leads 1 and 5) so they are perpendicular to the edge of the logic board. The tool presses against the sides of the contact to insure the contact positions are located correctly. The two screws passing through the battery contact connector and the logic board (to the bottom case) MUST be installed. These two screws press the base of the outer contacts to the power contact pads on the logic board. Once aligned to the logic board, these two leads make repeatable and reliable contact with the positive (+) and negative (-) battery contacts.

Use the battery contact alignment tool:

- Any time a battery contact screw (Figure 3) is loosened, removed, or replaced.
- Whenever a Powerbook Duo logic board is installed or reassembled into a system. The alignment tool should be in place before any screws are replaced.
- Any time a PowerBook Duo is experiencing symptoms such as shuts down unexpectedly, won't boot off the battery, intermittent powers off when running off the battery, or battery won't charge.
- To determine if the battery contacts are out of alignment.

To use the battery contact alignment tool,

1. Remove the main battery, keyboard, end clutch covers, and top cover.
2. As you slide the battery alignment tool into the battery bay, watch the battery contacts. There should be no resistance or flexing of the contacts. (See Figure 3 for tool orientation.)
3. If the outer battery contacts are not aligned correctly, loosen the two battery contact screws, slide the tool into place, and tighten the contact screws.

All service modules (new and repaired) have the battery contact alignment of the center three leads (leads 2, 3 & 4) verified by Apple prior to releasing the modules into service inventory. If any of the three center (soldered down) contacts are misaligned, the board should be replace and returned for misaligned contacts.

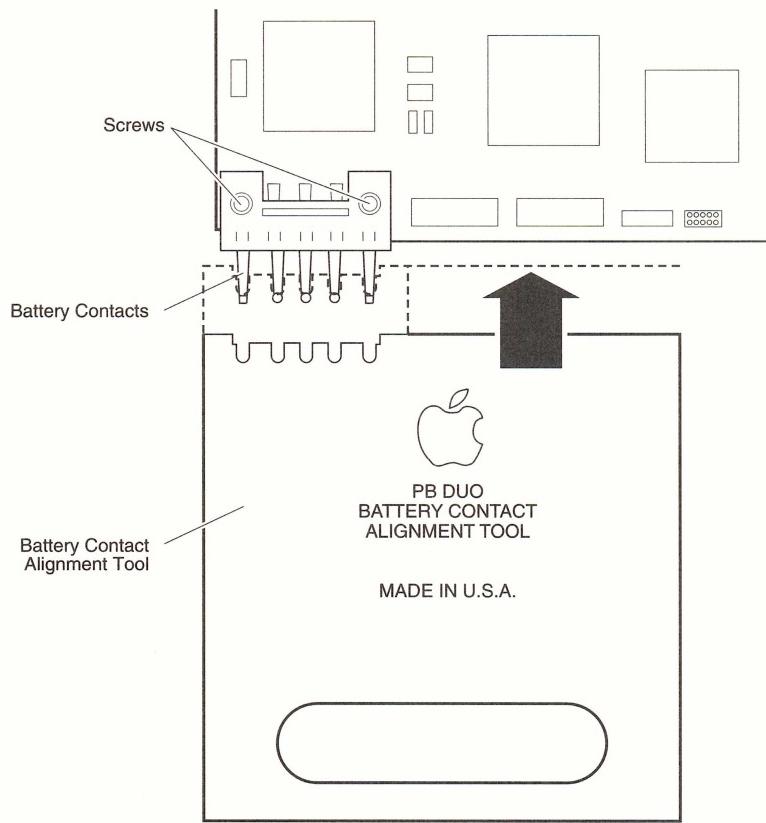


Figure 3 Duo Battery Contact Alignment Tool

Replacing the CPU Stiffener

1. Disconnect the power adapter.
2. Remove the main battery, keyboard, end clutch covers, top case, center clutch cover, hard drive, backup battery, trackball assembly, and display assembly.

▲ Warning

The PowerBook Duo contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Chapter 1, CRT and ESD Safety.

3. PowerBook cables are fragile and easily torn or damaged. Handle all cables with care. Using a jeweler's screwdriver, carefully disconnect the display switch cable.
4. Remove the microphone from the CPU stiffener.
5. Remove the three screws that secure the CPU stiffener to the bottom case. Lift the CPU stiffener with attached rear cover straight up and remove it from the bottom case.
6. Check that both EMI clips are securely attached to the CPU stiffener. If the clips are not secure, replace the stiffener. When replacing the CPU stiffener, be sure to wrap the hard drive EMI shield around the outside of the stiffener.
7. If you are replacing a damaged CPU stiffener, first remove the display switch and the display actuator. Return the stiffener with the rear cover attached.
8. If you replace a CPU stiffener on a PowerBook Duo 250 or 270c, make sure you install a small foam heatsink under the delineated area of the stiffener's tab. If you replace a CPU stiffener on a PowerBook Duo 280 or 280c, make sure you install a large foam heatsink under the entire tab. Failure to install the correct heatsink could cause a short circuit and blow out the logic board.

Battery Handling

The PowerBook Duo main battery is a nickel-metal-hydride (NiMH) battery. To extend its longevity, follow the instructions below.

- ▲ **Warning** **Return undamaged, dead NiMH batteries to Apple—do not discard dead batteries with other waste. If the battery is damaged, do not return it to Apple. Dispose of damaged batteries according to local ordinances.**
-

Follow these guidelines for properly handling the NiMH battery:

- Handle the battery carefully. Do not drop, puncture, disassemble, mutilate, or incinerate the battery.
- Fully charge a replacement battery before using it; Apple ships batteries in a partially-charged state.
- Do not leave the battery in the computer for longer than a week without recharging.
- To maximize battery life, discharge and then recharge the battery once every 30 days. Use only the power adapter or recharger supplied with the Macintosh Duo system.
- Store the battery in the protective battery case. For additional battery cases, see the Parts List.
- Do not short-circuit the battery terminals.
- Keep the battery in a cool, dark place; do not store it for longer than 6 months without recharging.

Battery Recharger

Using the PowerBook power adapter, plug the battery recharger into a power outlet and insert the main battery into the recharger. If the LED is

- Yellow, the battery is charging
- Green, the battery is ready to use
- Red, the battery is Type 2 or Type 3 and the recharger is Type 1 (the battery will not charge). Or, the Type 2 recharger has not been updated with software for a Type 3 battery (see Note below)
- Off, the recharger is unplugged, the battery is bad, the power adapter is defective, or the recharger is defective

Use only Type 1 batteries in a Type 1 battery recharger; Type 2 or Type 3 batteries will not charge in a Type 1 battery recharger.

You can charge Type 1, Type 2, or Type 3 batteries in a Type 2 battery recharger. However, the first time (only) that you charge a Type 3 battery in a Type 2 recharger, the recharger must be connected to a Duo with “Type III Battery” in the Extension folder. If you fail to do this, the Type 3 battery will not charge.

To identify types of batteries, check the bottom of the battery. Type 3 batteries include the description “High-Capacity Type 3” in the upper-right corner. Type 2 batteries include the description “High-Capacity Type 2” in the upper-right corner. Type 1 batteries do not include this description.

To identify types of battery rechargers, check the bottom of the recharger. A Type 1 recharger is imprinted with “Macintosh PowerBook Duo Battery Recharger.” A Type 2 recharger is imprinted with “PowerBook Duo Battery Recharger.”

PowerBook Duo Upgrades

PowerBook Duo upgrade kits are available to international and CPRC repairers only.

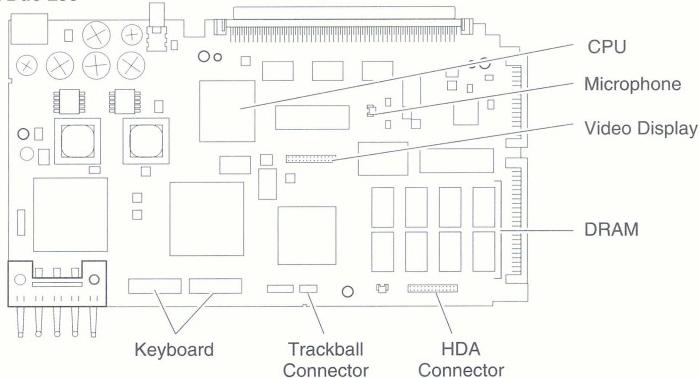
A PowerBook Duo 250 upgrade kit upgrades a PowerBook Duo 210/230 to a PowerBook Duo 250. The upgrade kit includes a PowerBook Duo 250 logic board, display assembly, and minimal accessory kit.

A PowerBook Duo 270c upgrade kit upgrades a PowerBook Duo 210/230 to a PowerBook Duo 270c. The upgrade kit is an assembled PowerBook Duo 270c without the keyboard, trackball, and hard drive.

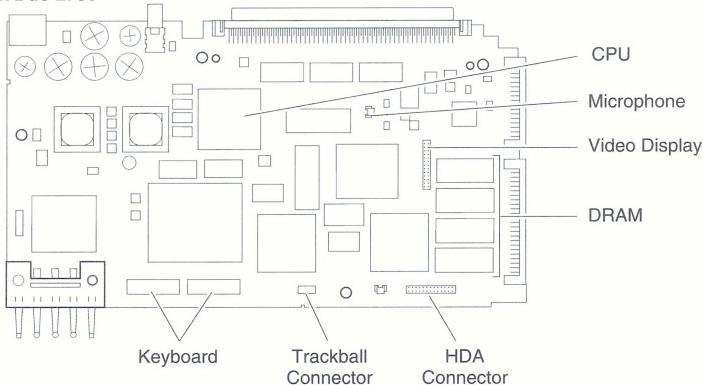
The PowerBook Duo 280/280c upgrade kit upgrades a PowerBook Duo 250 to a PowerBook Duo 280 or a PowerBook Duo 270c to a 280c. The upgrade kit includes a PowerBook Duo 280 logic board, case bottom with new label, CPU stiffener, display cable, Type 3 battery, 36 W power adapter, and miscellaneous parts.

Logic Board Diagrams

PowerBook Duo 250



PowerBook Duo 270c



PowerBook Duo 280, 280c

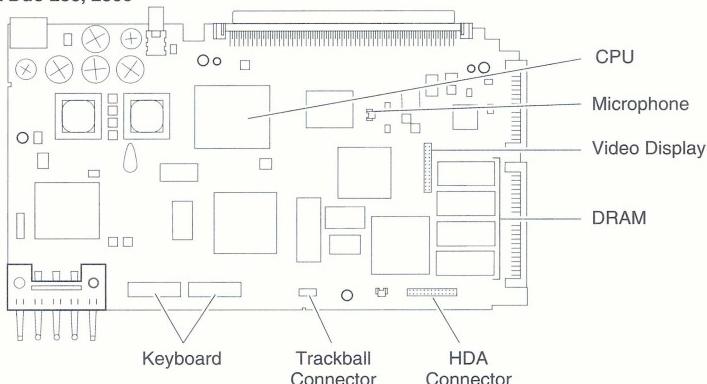
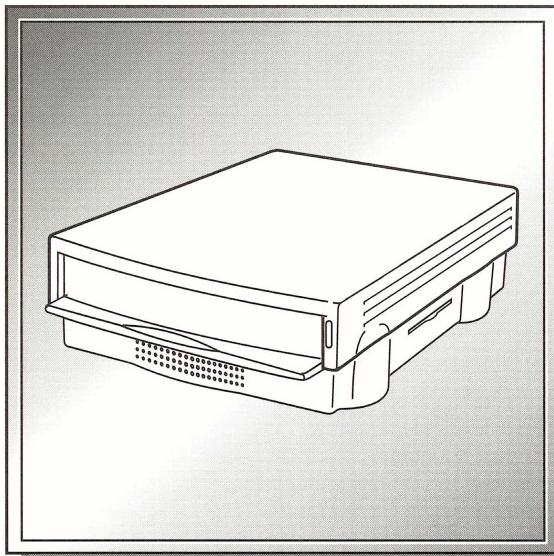


Figure 4 Logic Boards

Duo Dock II



Illustrated Parts List	324
Specifications	326
Symptom/Cure Chart	328
Duo Dock II Upgrades	334
Logic Board Diagram	334

Illustrated Parts List – Duo Dock II

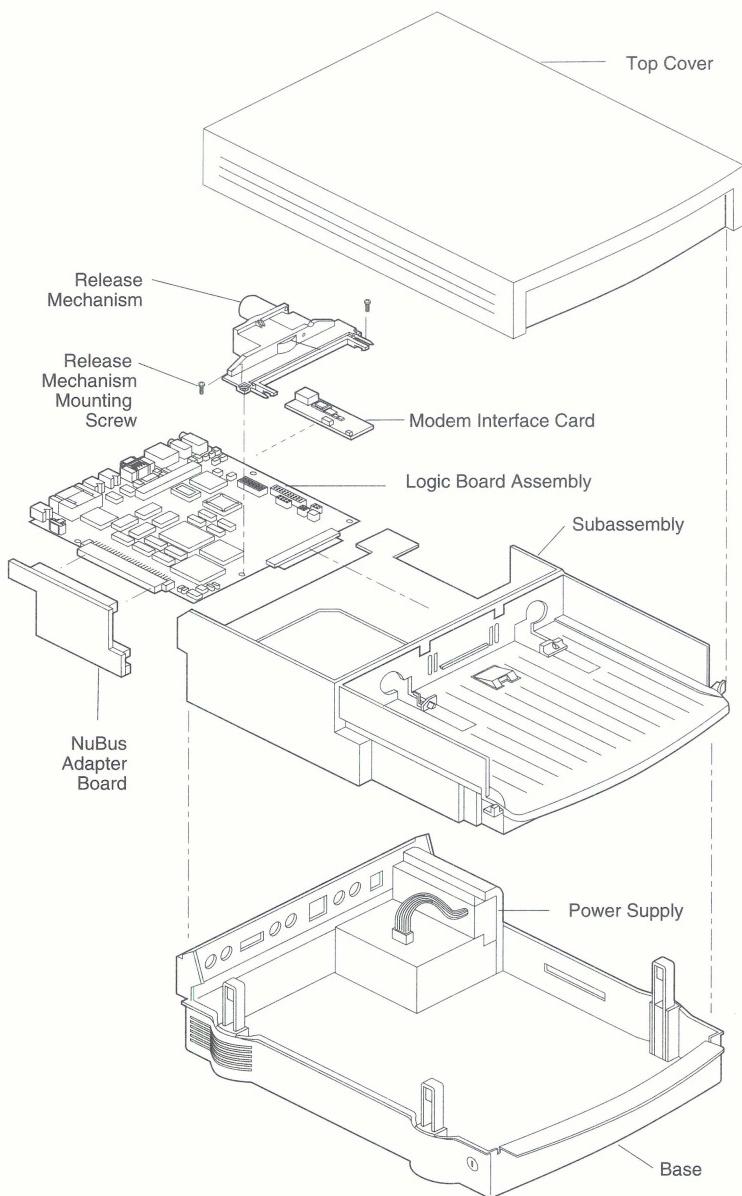


Figure 1 Duo Dock II Exploded View

Base Assembly	
Base, Rev. B .....	.076-0465
Feet (4).....	.922-0109
Lock Plug Assembly w/(2) Keys .....	.922-0108
Port Cover, Blank (Bag of 5) .....	.922-0962
Port Cover, Ethernet (Bag of 5).....	.922-0963
Power Cord, AC .....	.922-0054
Power Supply .....	.661-1660
Cover	
Top Cover.....	.815-0459
Top Cover, Duo Dock w/Door, Rev. B.....	.922-0521
Expansion Cards	
Modem Interface Card, Domestic.....	.922-0095
Modem Interface Card, International.....	.922-0094
Hard Drive	
Drive Carrier, HDA, 3.5" SCSI, InterNational .....	.805-0980
HDA, Cable .....	.922-0337
HDA Power Cable .....	.922-0338
HDA, 230 MB, 3.5" SCSI.....	.661-1637
Screw, 6-32 x .250 (Carrier to HDA) .....	.444-6104
Logic Board Assembly	
Logic Board .....	.661-1675
Math Coprocessor .....	.922-0107
NuBus Adapter PCB.....	.922-0102
Screw Kit, Duo Dock .....	.076-0110
SIMM, 512K, Video RAM .....	.661-0649
Release Mechanism.....	.922-0336
Subassembly	
Apple SuperDrive 1.4 MB Drive Mechanism .....	.661-0474
Cable, Floppy Drive.....	.922-0111
Ejector Assembly.....	.922-0104
NuBus Adapter Card Guide.....	.922-0110
Plastic Internal Subassembly, Rev. B .....	.076-0466
Speaker Assembly .....	.922-0105
Miscellaneous	
Apple Extended Keyboard II.....	.661-0543
Apple Keyboard II.....	.661-0603
HDA, 250 MB, 3.5" SCSI, Unhoused .....	.661-0890
Jumper, SCSI ID for HDA (10 pack).....	.517-0546
Microphone Assembly .....	.699-5103
Mouse, Apple Desktop Bus .....	.661-0479
Mouse, Apple Desktop Bus II .....	.661-0763
On-Site Warranty Reimbursement, Per Repair .....	.602-0308

Specifications – Duo Dock II

Processor	Motorola 68882 FPU chip and 32K RAM cache; 33 MHz Addressing: 32-bit internal registers, address and data bus
Memory	RAM: Configuration ROM (differentiates between docking devices) VRAM: 1 MB of VRAM soldered on logic board; no slot for additional VRAM expansion
Disk Storage	Floppy Drive: Internal 1.4 MB floppy drive; SWIM II MFM/GCR disk controller chip Hard Drive: 230 MB, 3.5-in., 1-in.-high SCSI hard drive; internal 50-pin SCSI connector; external HDI-30 SCSI port
I/O Interfaces	ADB: Apple Desktop Bus (ADB) port (recommend maximum of three low-speed, synchronous ADB devices); mini DIN-4 connector; 200 mA maximum current draw for all ADB devices Docking Connector: Internal 152-pin processor-direct slot (PDS) connector to PowerBook; 32-bit expansion bus Ethernet: One internal Ethernet port Modem: Pass-through telephone jack for optional internal (PowerBook Duo) modem; RJ-11 domestic; mini DIN-8 international NuBus: Two internal NuBus slots; two 15 W cards, or one each at 25 W and 5 W SCSI: HDI-30 SCSI port with 1.5 MB/sec. transfer rate; supports up to six external SCSI devices (five if drive is installed); includes built-in terminator Serial: Two RS-422 serial ports; mini DIN-8 connectors Sound: Monoaural sound-in port (requires 20 dB attenuation cables and adapter to accommodate audio equipment with line level outputs); monoaural sound output jack for external audio amplifier
I/O Devices	Keyboard: Built-in Apple Keyboard II and Apple Extended Keyboard Microphone: External electret; omnidirectional microphone; output voltage of 4 mV, peak-to-peak Mouse: Apple Desktop Bus mouse and ADB Mouse II Speaker: 16 Ω magnetic, moving coil speaker Video Support: 1 MB of on-board VRAM; supports most Macintosh monitors (including Apple Multiple Scan monitors) up to 21-in. color; supports some VGA monitors; includes Sync On Green feature
Electrical	Universal AC power supply, 90-270 VAC; provides 75 W continuous power, 85 W surge power, 47-63 Hz, single phase input line frequency; charges PowerBook Duo batteries and power Duo Dock I or II
Physical	Height: 158 mm Width: 12.75 in. (323.7 mm) Depth: 16.37 in. (415.6 mm) Weight: 15 lb. without hard drive; frame supports up to 85 lbs.

Other	<p>Modem: Telephone line interface (DAA) circuitry (domestic); support for external telephone line interface (DAA) circuitry (international); RJ-11 connector (domestic); mini DIN-8 connector (international)</p> <p>Docking Motor: Motorized injection/ejection mechanism draws the PowerBook Duo system into the Duo Dock and ejects the system from the Duo Dock; DC motor operates at 5 rpm and provides 16-30 lb. of pull-in force</p> <p>Security: Key locking device at left front of unit locks PowerBook Duo computer into the Duo Dock; each lock is unique (no master key is available); 125 key combinations; key codes will be released to locksmiths; hook at rear of monitor stand can be used with Kensington mechanism to lock Duo Dock to the desktop</p>
--------------	--

Symptom/Cure Chart – Duo Dock II

Startup Problems	Solutions
RAM failure occurs (eight-tone error chord sequence sounds after startup chord)	<ol style="list-style-type: none">1. Eject PowerBook Duo. Reboot and troubleshoot computer only.2. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Hardware failure occurs (four-tone error chord sequence sounds after startup chord)	<ol style="list-style-type: none">1. Eject PowerBook Duo. Reboot and troubleshoot computer only.2. Disconnect hard drive data cable, install standard Apple SCSI terminator, and reboot system. If startup sequence is normal, reseat cable, remove terminator, and retest. If failure recurs, replace hard drive.3. Disconnect floppy drive cable and reboot system. If startup sequence is normal, reseat cable and retest. If hardware failure recurs, replace floppy drive.4. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Power Problems	Solutions
System doesn't respond	<ol style="list-style-type: none">1. Eject PowerBook Duo. Reboot and troubleshoot computer only.2. Check all Duo Dock logic board cable connectors.3. Replace Duo Dock power supply.4. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
System intermittently crashes or locks up	<ol style="list-style-type: none">1. Make sure system software is 7.1 or higher.2. Make sure software is known-good.3. Eject PowerBook Duo. Reboot and troubleshoot computer only.4. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.5. Replace Duo Dock power supply.
Video Problems	Solutions
No external display, but computer appears to operate correctly	<ol style="list-style-type: none">1. Adjust screen contrast.2. Reseat video cable.3. Replace video cable.4. Replace video interface card (if installed).5. Replace VRAM SIMM (if installed).6. Try known-good external display. If now OK, replace and troubleshoot original display.7. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.

-
- Raster or video display problems at external monitor
1. Reseat video cable.
 2. Replace video cable.
 3. Replace video card (if installed).
 4. Replace VRAM SIMM (if installed).
 5. Try known-good external display. If now OK, replace and troubleshoot original display.
 6. Eject PowerBook Duo. Reboot and troubleshoot computer only.
 7. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.

Floppy Drive Problems

Solution

- Audio and video present, but internal floppy drive does not operate
1. Try known-good floppy disk.
 2. Check floppy drive cable connection.
 3. Replace floppy drive cable.
 4. Replace floppy drive.
 5. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.

- Disk ejects while booting; display shows Mac icon with blinking "X"
1. Try known-good system disk.
 2. Verify that mouse button is not stuck.
 3. Check floppy drive cable connection.
 4. Replace floppy drive cable.
 5. Replace floppy drive.
 6. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.

Disk does not eject

1. Switch off system. To eject disk, hold mouse button down while you switch system on.
2. Insert straightened paper clip into hole next to drive opening and eject disk.
3. Check floppy cable connection.
4. Replace floppy drive cable.
5. Replace floppy drive.
6. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.

Disk initialization fails

1. Verify that you are using correct media.
2. Try known-good floppy disk.
3. Check floppy drive cable connection.
4. Replace floppy drive cable.
5. Replace floppy drive.

Read/write/copy error

1. Verify that you are using correct media.
2. Try known-good floppy disk.
3. Check floppy drive cable connection.
4. Replace floppy drive cable.
5. Replace floppy drive.

Hard Drive Problems	Solution
Internal PowerBook Duo hard drive does not operate	<ol style="list-style-type: none"> Eject PowerBook Duo. Reboot and troubleshoot computer only.
Internal Duo Dock hard drive does not operate	<ol style="list-style-type: none"> Check internal hard drive data cable connection. Replace internal hard drive data cable. Run Macintosh Hard Disk Test. Use HD SC Setup to reinitialize drive. Replace internal hard drive. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Internal hard drive works, but external SCSI device does not	<ol style="list-style-type: none"> Make sure external devices have unique switch settings between 2 and 6. Make sure SCSI chain is terminator at last device only. Replace external SCSI terminator. Troubleshoot external SCSI device.
Drive does not appear on desktop	<ol style="list-style-type: none"> Restart system. Verify that SCSI devices have unique addresses. Use HD SC Setup to initialize drive.
Peripheral Problems	Solutions
Cursor does not move, or moves erratically	<ol style="list-style-type: none"> Simultaneously press Command, Control, and Power On keys to reset computer. Check ADB connections. Inspect and clean mouse, if necessary. If mouse was connected to keyboard, try it in ADB port. If OK, replace keyboard. Replace mouse. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Cursor moves, but clicking mouse button has no effect	<ol style="list-style-type: none"> Replace mouse. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
No response to any key on keyboard	<ol style="list-style-type: none"> Press Power On key or power button. Check keyboard cable connection. Replace keyboard cable. Replace keyboard. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.

-
- | | |
|---|---|
| Cannot double-click to open application, disk, or server | <ol style="list-style-type: none">1. Remove any multiple system files.2. Inspect and clean mouse, if necessary.3. Clear parameter RAM and reset mouse controls.4. If mouse was connected to keyboard, try it in ADB port. If OK, replace keyboard.5. Replace mouse.6. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator. |
| After you connect external SCSI device, computer doesn't boot | <ol style="list-style-type: none">1. Switch on external SCSI device before starting computer.2. Check cable connections.3. Verify that standard Apple terminator terminates SCSI chain.4. Verify that SCSI select switch setting on external device is unique.5. Verify operation of internal hard drive.6. Try known-good external SCSI device.7. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator. |
| Known-good ImageWriter, ImageWriter II, or LQ does not print | <ol style="list-style-type: none">1. Verify that system is 7.1 or later.2. Verify that Chooser and control panel settings are correct.3. Check cables.4. Replace printer interface cable.5. Try known-good printer.6. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator. |
| Known-good LaserWriter does not print | <ol style="list-style-type: none">1. Verify that system is 7.1 or later.2. Verify that Chooser and control panel settings are correct.3. Check cables.4. Replace printer interface cable.5. Try known-good printer. If printer works, troubleshoot network. |
| Device connected to external modem port doesn't work | <ol style="list-style-type: none">1. Verify that External Modem is selected in PowerBook Duo control panel.2. Verify that system is 7.1 or later.3. Check cables.4. Test device with known-good computer.5. Eject PowerBook Duo and test device at PowerBook Duo external modem/printer port.6. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator. |

I/O devices are are unrecognized or garbage is transmitted or received	<ol style="list-style-type: none"> 1. Verify that system is 7.1 or later. 2. Check cables. 3. Verify that SCSI devices are terminated properly. 4. Verify that SCSI select switch setting on external device is unique and is set to a number between 2 and 6. 5. Test device with known-good computer. 6. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Internal Modem Problems	Solutions
Internal modem options do not appear in CDEV	<ol style="list-style-type: none"> 1. Verify that system is 7.1 or later. 2. Remove and reseat modem interface board. 3. Eject PowerBook Duo and test internal modem. 4. Replace modem interface board. 5. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Modem does not respond properly to AT command set instructions	<ol style="list-style-type: none"> 1. Verify that baud rate and data format settings of communications application are compatible with internal modem and remote modem. 2. Check phone cord connection and operation. 3. Verify that system is 7.1 or later. 4. Remove and reseat modem interface board. 5. Eject PowerBook and test internal modem. 6. Replace modem interface board. 7. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Strange mix of characters appears on screen	<ol style="list-style-type: none"> 1. Verify that baud rate and data format settings of communications application are compatible with internal modem and remote modem. 2. Check phone cord connection and operation. 3. Verify that system is 7.1 or later. 4. Remove and reseat modem interface board. 5. Eject PowerBook Duo and test internal modem. 6. Replace modem interface board. 7. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Modem interferes with system sound	<ol style="list-style-type: none"> 1. Remove and reseat modem interface board. 2. Eject PowerBook Duo and test internal modem. 3. Replace modem interface board. 4. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.

Modem does not respond to incoming call	<ol style="list-style-type: none"> If computer is in sleep mode, verify that "Answer calls" is selected in Remote Access Setup control panel. Check phone cord connection and operation. Eject PowerBook Duo and test internal modem. Replace modem interface board. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Modem has no sound output	<ol style="list-style-type: none"> Verify that Volume control panel setting is 1 or higher. Eject PowerBook Duo and test internal modem. Replace modem interface board. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Modem connects but does not communicate with remote modem	<ol style="list-style-type: none"> Verify that remove modem needs error correction (error correction is internal modem default). Type AT&QO to disable error correction.
Miscellaneous Problems	Solutions
Can't insert computer into dock	<ol style="list-style-type: none"> Unlock door and insert computer. Open I/O door on computer and insert computer. Replace ejector assembly. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Can't eject computer from dock	<ol style="list-style-type: none"> Unlock door and press eject button again. If no power to dock, insert dock's key or small screwdriver into square hole on side of dock and press to manually eject computer. Replace ejector assembly. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
No sound from speaker	<ol style="list-style-type: none"> Verify that Volume control panel setting is 1 or above. Check speaker-to-logic board cable connection. Replace Duo Dock logic board. Retain VRAM SIMM, math coprocessor, and SCSI terminator.
Ejects computer when you attempt to start up from keyboard	<ol style="list-style-type: none"> Shut down PowerBook Duo and insert it again.

Duo Dock II Upgrade

Upgrade the Duo Dock to a Duo Dock II by adding a new logic board and top cover. These parts are available individually, not as a kit.

▲ Warning **The Macintosh Duo Dock contains CMOS devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Chapter 1, CRT and ESD Safety.**

1. Remove the top cover, release mechanism, subassembly, and modem interface card (if installed).
2. Install the Duo Dock II logic board and top cover.

Logic Board Diagram

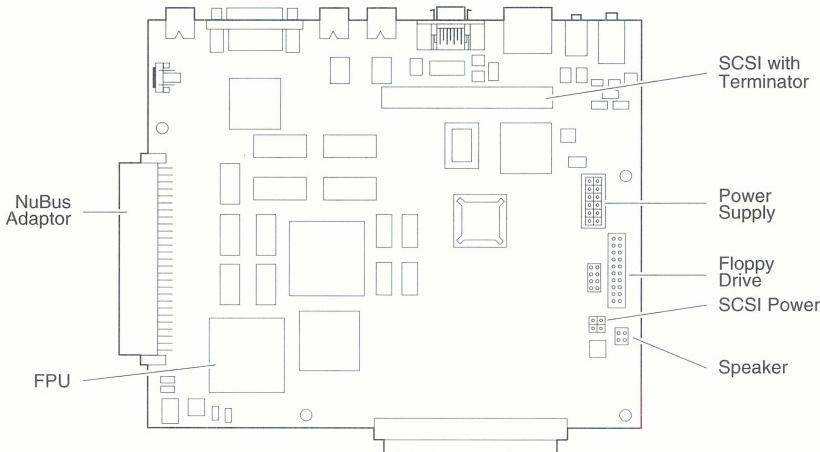


Figure 2 Duo Dock II Logic Board



Apple Computer, Inc.
1 Infinite Loop
Cupertino, California 95014
TLX 171-576

072-0048